# Pit and Quarry

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## BEFORE THE ALTAR OF PRICE

IT WAS during Roosevelt's administration that the great American public was finally successful in communicating to the American retailer the fact that they were severally divided with regard to their buying habits and desires. By irrefutable performance they indicated that while a few thousand were willing to pay $18 for a hat, hundreds of thousands wanted to pay $9 for their hat and limitless millions made up the market for good hats at $4 each. Manufacturers in general accepted the verdict and automatically classified themselves and their product with the consuming public by the price tags affixed to their merchandise.

What happened to hats also affected shoes, automobiles, neckties, lawn mowers, gold fish and fence. No commodity remained unaffected by the change in market conditions with the result that we have batteries ranging in price from $7.50 to $28; $1.50 to $8 fountain pens; $10 to $800 phonographs, and goblets sold by Woolworth and Wanamaker. Under this changed condition the manufacturer was compelled to set up certain standards of value per dollar of cost. Competition became the leveler of prices and the correcting medium for inequality. If the value of one product is noticeably less than that of a competitive product in the same price range, the public quickly decides which product shall be consumed and which manufacturer shall increase or lower the price.

To superficial thinkers whether in public, retailing, jobbing or manufacturing endeavor, this change in market conditions might appear to be setting up of a price altar before which everyone must salaam. On the contrary, our existing market condition is just as it should be. In spite of current and oft-discussed beliefs, we are not worshippers of price. At no time has the public ever demanded a $20 value for a $10 price. No one has ever asked Ford to put a twin-six motor in his $600 car and none has ever asked for an 8-tube hetrodyne for the price of a crystal set. The American public does not now, and never has, worshipped before the shrine of price and the dealer or jobber who thinks it does or the manufacturer who gives unduely large discounts shades his price, under the fallacious belief that price is all important, is merely cutting his own profits and contributing to the demoralization of industry.

This is not to say that discounts or special quantity prices do not provide incentive for increased sales. Perhaps a manufacturer, through some act of good business judgment, such as the installation of new and better manufacturing equipment, extremely favorable purchases of large quantities of raw material or minimized sales expense has effected a considerable reduction in costs. Under such a condition it is only natural that he should keep his established prices and pass along some of the benefit of his good judgment in the form of economically sound discounts. But not otherwise.

The American public kneels before the altar of quality—not before the shrine of price. Quality, consistent with cost, is sought by every one of our hundred million American buyers and the sooner trade in general assimilates that fact and conforms its business to it the better will be all industry.

The sole means to the end of better profits is quality. Quality products and quality merchandising. The manufacturer who, regardless of product, can keep one step ahead of the cycle of public preference and demand and uphold a high standard of quality—that is the manufacturing business that will grow and his is the product that will establish the standard of value for the public. Likewise the distributor, dealer or consumer who looks beyond discounts to quality in both product and policies is the one who will gain constantly increasing value, per dollar invested.

## BEFORE THE HORSE IS STOLEN

HOW the rise of one industry can play havoc with an established industry is shown in figures from the 1925 census of manufacturers, recently made public by the United States Department of Commerce. According to these figures, the number of phonograph manufacturers decreased 39 per cent, from 1923 to 1925, and the value of their products fell from $107,000,000 to $61,000,000, or 61 per cent, in the same period. The radio industry is believed to be, and doubtless was, the cause of this shrinkage in the phonograph industry.

In commenting on this and similar changes in industry, a nationally known business executive of New England said:

"For some years I have maintained the policy of

investing in no establishment which does not maintain a research department, either as an integral part of its organization or by retaining adequate scientific services, in such a manner as to keep in close contact with new developments which might have a bearing on the company's prosperity."

What does research mean? In brief, it means knowing the facts in advance by systematic plan of fact finding. Research is not a luxury, it is a necessity—a form of accident insurance. Research supplies the motive power for advance. It is the foe to guess-work and hunches. It substitutes information for opinion.

As the Metropolitan Life Insurance Company puts it: Science instead of surmise is the best guide to policy, whether it concern production, sales, or service to employees, to customer, and to public. Put a foundation of scientific fact finding before and behind every policy you sponsor and you will help your associates to steer clear of the rocks. A fact-controlled business is secured against surprise attacks. Locking the stable door before the horse is stolen is prudence. Spotting the horse-thief before he gets into the stable yard is wisdom.

## PRINCIPLE IN BUSINESS

THE function of business is to provide for the material needs of mankind, and to increase the wealth of the world and the value of happiness of life. In order to perform its function it must offer a sufficient opportunity for gain to compensate individuals who assume its risks, but the motives which lead individuals to engage in business are not to be confused with the function of business itself. When business enterprise is successfully carried on with constant endeavor to reduce the costs of production and distribution, to improve the quality of its products, and to give fair treatment to customers, capital, management, and labor it renders public service of the highest value.

PERMANENCY and continuity of service are basic aims of business, that knowledge gained may be fully utilized, confidence established and efficiency increased.

THE FOUNDATION of business is confidence, which springs from integrity, fair dailing, efficient service, and mutual benefit.

THE REWARD of business for service rendered is a fair profit plus a safe reserve, commensurate with risks involved and foresight exercised.

EQUITABLE CONSIDERATION is due in business alike to capital, management, employees and the public.

KNOWLEDGE—thorough and specific—and unceasing study of the facts and forces affecting our business are essential to a lasting individual success and to efficient service to the public.

OBLIGATIONS to ourselves and society prompt us unceasingly to strive toward continuity of operation and betterment of employment conditions.

REPRESENTATION of products and services should be truthfully made and scrupulously fulfilled.

WASTE in whatever form: capital, labor, services, materials, or natural resources, should be intolerable.

UNFAIR COMPETITION which embraces bad faith, deception, fraud, oppression or commercial bribery, is waste.

We pledge our LAWFUL COOPERATION in support of these principles of business conduct.

## CHEMISTRY AIDS COMMERCIAL DEVELOPMENT

FEW other industries have progressed as rapidly or proved of such universal aid as the chemical industry. No longer are we dependent upon foreign countries for many of our basic chemicals—due entirely to developments that have been brought about since 1904. In that period we have increased our production of dye stuffs from 6,000,000 pounds to 92,000,000 pounds; our pyrolin plastics from $13,000,000 to well over $110,000,000; and products made by electrochemical methods from $29,000,000 to $122,000,000. Singling out a few actual accomplishments that seem outstanding in importance, we list the following:

1—The development of greater efficiency in gasoline, more mileage per gallon. By the use of the "cracking" process the proportion of gasoline recovered from a barrel of petroleum has already been greatly increased. We may shortly expect to obtain substantially more mileage from gasoline through the use of tetra-ethyl of lead with more efficient motors.

2—The improvement of rayon yarns so as to make the fiber stronger. This promises to remove the objection to rayon fabrics that they tend to stretch out and weaken. Thus improved, rayon should become a closer competitor of milk.

3—The manufacture of what have always been considered as organic compounds, rubber, methanol, camphor, ascetic acid, from inorganic materials.

Of less immediate, but great ultimate importance, are projects for extracting oil froc oal, and making cotton and wool from wood pulp. These processes are claimed to be technically possible, and to have been successfully accomplished. But their commercial profitability is at present doubtful. Oil from coal or shale may prove to be of the utmost importance as natural sources become exhausted. At the present time, however, neither can compete, commercially, with flush production. These developments must be watched closely. They offer the opportunity for the building up of great and successful new enterprises. Some of them threaten the position of established lines of business.

# NEW SLAG CRUSHING AND SCREENING PLANT HAS MANY UNUSUAL FEATURES

SOUTH CHICAGO, Illinois, has now added to its long list of interesting, completed industrial features the new slag crushing and screening plant of the France Slag Company. This plant which has been in production for only a few weeks has a capacity of 120 tons per hour and is a model plant for its type and capacity. The general design was in charge of D. W. Yambert of the France Slag Company. Burrell Engineering and Construction Company designed and built the reinforced concrete bins. The foundation work was done by the Great Lakes Dredge and Dock Company. Warden and Allen erected the steel work.

The outstanding features of the plant can be listed as follows:

(1) Steady flow of material through the entire plant.

(2) Automatic removal of all iron by means of magnetic separators.

(3) Automatic plug stopping of crusher motor in case of trouble.

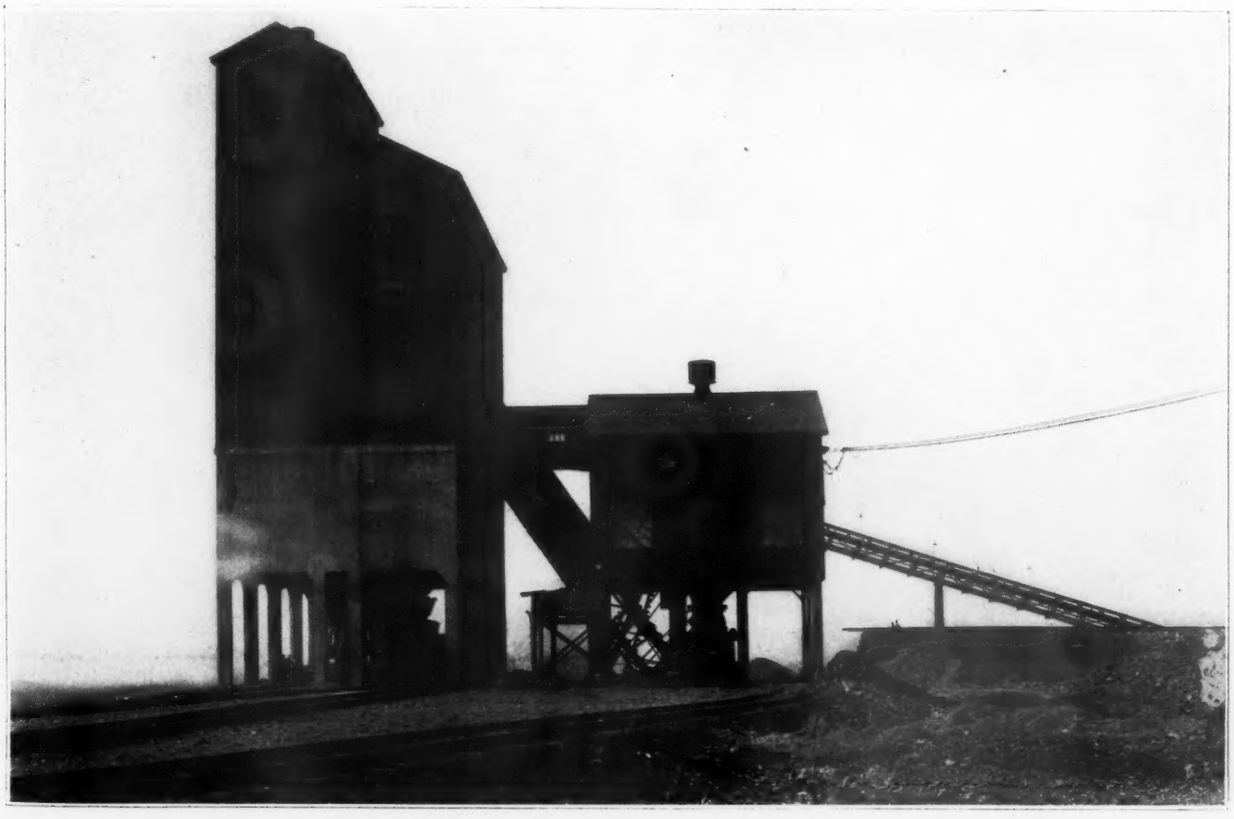
(4) All screens of the same size and type.

(5) All chutes of steel are designed (not cut) to fit.

(6) Individual electric motor drive throughout.

(7) Motors dust tight and ball bearing equipped.

E. L. Adams, Left, and H. J. King, Right. The Building is the Plant Office Now Completed



New Plant of the France Slag Company

Track from Slag Storage to Hopper

(8) Motor starting equipment totally enclosed and of the remotest control type.

(9) Motor starters electrically interlocked for starting in sequence.

(10) Oil and dust tight speed reducers on all drives except for crusher which is a texrope drive.

(11) Bins located over two tracks and so designed as to permit loading any size on either track.

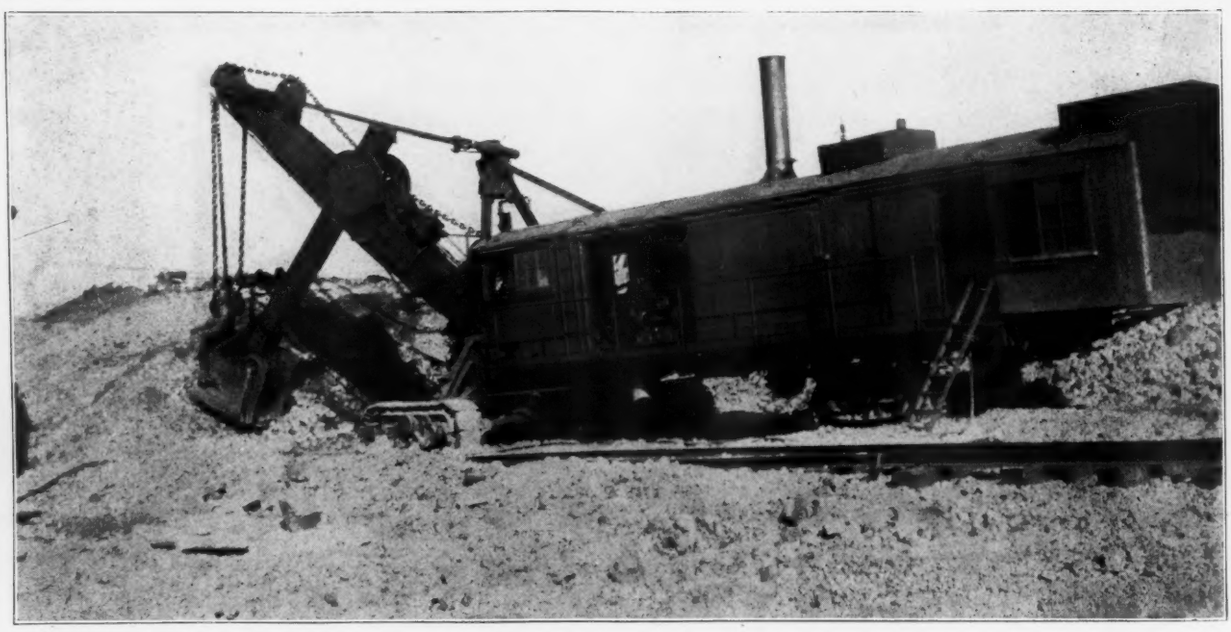
(12) Automatic removal of spalls and undersize during loading and automatic return to plant.

(13) An arrangement for returning rejected material to the plant for rescreening.

(14) Concrete and steel construction employed throughout.

Molten slag is brought in ladle cars from the iron furnaces of the Federal Furnace Company and dumped from either of two high line tracks into one of two parallel slag pits. These slag pits are each 900 feet long and 62 feet wide. Cool slag is dug out of one of the pits by a Model 91 Marion crawler traction steam shovel and loaded into railroad hopper cars on the reclaiming track, while the hot slag is being poured into the other slag pit. The reclaiming track is practically level and runs parallel and between the two slag pits. This arrangement is shown in one of the illustrations. The cars are hauled from the plant and dumped one at a time into a 50 ton capacity track hopper. The top of this hopper is equipped with a welded structural steel grating with 15 inch square openings. Any material remaining on top of the grate is too large to be handled by the plant equipment and is swung aside by means of a small stiff leg crane. The amount of such material at this particular plant, however, is almost negligible. At the bottom of this track hopper is a Webster reciprocating plate feeder of 200 tons per hour capacity which feeds and regulates the flow of material to a 36 inch, 133 foot centers belt conveyor with a Goodyear belt and Robins idlers. This belt is inclined at about 33⅓ degrees and elevates the material to a point above the crusher. The head pulley of this conveyor is a 36 by 38 inch Dings magnetic separator for removing large pieces of iron before the material gets to the crusher. The iron clings to the pulley and travels round with it until the belt, as it is leaving the other side of the pulley, forces the iron away from the pulley and out of its magnetic influence. The iron then drops through an iron chute into a small car provided for receiving this material and is later returned to the furnaces.

The slag containing little or no iron is discharged from the belt conveyor onto a bar grizzly with spacings of 4 inches. This grizzly partially removes the finer material which by-passes the crusher, while the coarser material falls into a large stone box and rolls into the crusher. The material by-passing the crusher and the material discharged



Shovel Used for Digging and Loading Slag

from the crusher are both picked up by a 26 by 24 inch Webster continuous pan conveyor, carrying 128 buckets at a speed of 80 feet per minute on an incline of 55 degrees with centers of 121 feet, and elevated to the top of the screen house. The crusher is a number 8 McCully gyratory and is driven by a 60 h.p. General Electric air cooled motor.

The pan conveyor, with its material from the crusher and the by-pass from the crusher, discharges onto a short 48 inch belt conveyor, the head pulley of which has a 15 inch face by 24 inch diameter Dings magnetic separator. The purpose of this Dings pulley is to remove any small pieces of iron liberated from the slag by pressure. The iron which is removed drops to a small iron bin.

The short 48 inch belt conveyor discharges the slag to a 60 inch by 24 foot triple deck revolving screen which removes as much as possible of the 3/16 to nothing material and cleans and sizes material from 2½ to 4½ inches and from 1¼ to 2½ inches. The material over 4½ inches is discharged to a 24 inch, 55 foot centers return belt conveyor and is carried back and fed to the crusher. This primary screen has an outer jacket with ½ inch openings, and a second jacket of 2 inch square mesh. The barrel of this primary screen has 2½ inch openings except the last 4 foot section which has 4½ inch openings. The two finish sizes and the material from 3/16 inches down go directly to bins. The material between 1¼ and 3/16 inches goes to the floor below and is split fifty-fifty between two 60 inch by 24 foot triple-deck revolving screens. These screens again remove as much as possible of any remaining 3/16 inch to zero material and also prepare sizes from ¾ to 1¼ inches, ½ to ¾ and 3/16 to ½ inch, all of which go direct to the bins. The chutes for all sizes are arranged so that any desired mixture of sizes can be had. The gates between the bins are of the roll type operated by means of racket pinion and pocket sheave and chain. These two screens and the previous screen mentioned are all of the same type and size.

The gates beneath the bins are of the roller type operated by means of rack and pinion and pocket sheave and hand chain. There are eight slag bins with a combined capacity of 16 carloads located over two tracks. All the bins except the dust bins and the iron bin have gates near the partition which divides the two rows of bins, so arranged that a gate of a bin of one of the rows and a gate of the adjacent bin of the opposite row will discharge into a common chute. This chute is provided with a swing gate making it possible to direct the material from either bin to a car on either track. In other words all sizes can be loaded to either track. In case of both truck and rail shipments this feature would be quite advantageous in that one track

Magnetic Pulley Ahead of Crusher

could be entirely for railway cars and the other track entirely for trucks, and it would be possible to load all sizes in either cars or in trucks. There are chutes leading from this common chute to the car, which chutes are provided with gravity screens for removing spalls and undersize material.

The spalls and undersize material are discharged onto a 24 inch belt conveyor running lengthwise of the rows of bins. This conveyor discharges onto another 24 inch belt conveyor running at right angles to the rows of bins and located in an underground pit. This last mentioned belt conveyor discharges into a small chain elevator which elevates the spalls and undersize material and discharges it into the 26 by 24 inch Webster continuous pan conveyor which in turn elevates it along with its regular load of slag from the crusher to the top of the screen house to be re-sized.

There is a small track hopper and reciprocating plate feeder located just above this last mentioned belt conveyor, which returns rejected or dirty material to the screens for re-sizing. The material in this case goes from the plate feeder to the belt conveyor, to the small chain elevator, to the 26 by 24 inch Webster Continuous pan conveyor, and through the screens.

The site on which the plant has been built was pretty well under water, so concrete and reinforced concrete piles had to be driven as a foundation. Piles from 25 to 35 feet were sunk. This work was done by the Great Lakes Dredge and Dock Company. The Burrell Engineering and Construction Company did an excellent piece of work in the design and erection of the concrete bins. The bin structure is 40 by 64 feet, and the bin depth 20 feet. There are two rows of four bins each, all of the same size, and a corner of one has been used as a small iron bin for the iron removed by the magnetic separator. Slip form construction methods were used. The forms were set in place on top of the foundations and bulkheaded for the first story columns. After the columns were poured, the bulkheads were removed and the bin walls were gradually poured as the slip forms were slowly elevated by means of jacks. This type of construction results in a concrete that is truly monolithic from bottom to top, and it presents a much neater surface appearance than stationary form concrete. A slip form only four feet high facilitates better puddling and tamping and helps eliminate the separation of aggregate from the cement and sand, thus resulting in a stronger and a more uniform concrete from the bottom to the top. Slag aggregate was used, providing another contribution toward

Reclaimed Iron More Valuable Than Slag

greater strength.

The remainder of the plant structure is of structural steel and was fabricated and erected by Worden Allen Company. This company succeeded in completing a very satisfactory installation of mixing chutes leading from the revolving screens to the bins. The detailing of these chutes was evidently a most difficult task, and the individual who did the job deserves much credit. The steel design for the entire plant was handled by Mr. K. Weinell of H. A. Brassert and Company, Chicago. The siding and roofing and ventilators are of asbestos and asphalt protected metal furnished and installed by H. H. Robertson Company. This metal was selected because of its ability to withstand the corrosive gases and dilute acids to which it is subjected in the vicinity of blast furnaces, and because it does not require painting from time to time, being practically maintenance free. The metal was delivered to the site cut to size and shape, thus resulting in a quick erection job.

All belt conveyor machinery is of the anti-friction bearing, Alemite oiled type and was furnished by Robins Conveying Belt Company. The troughing idlers are Timken taper roller bearing equipped, while the return idlers run in Hyatt roller bearings. All idlers, both troughing and return, are made of cast iron in order to resist corrosion. Troughing idlers for the 36 inch and the 48 inch belts are made up of five pulleys each and for all other belts of three pulleys each. All head, tail, bend, and take up pulleys are rubber lagged in order to provide better friction and minimize slippage and wear.

The two reciprocating plate feeders and the continuous pan conveyor were furnished by the Webster Manufacturing Company. The plate feeders are provided with adjustable throw cranks for use in regulating the amount of feed. Plate feeders are slow moving apparatus and are one of the most satisfactory means of regulating flow of material. The pan conveyor is a continuous bucket elevator, 120 feet centers, with super capacity style buckets 26 inches wide by 24 inches pitch, mounted between two strands of steel bar bushed rolled chain, inclined at 55 degrees and running at a speed of 80 feet per minute. The rollers are fitted with Zerk oilers. The buckets are designed to fill well at steep inclinations, and are so designed and mounted that the gap between them does not increase or decrease in going around the sprockets, thus eliminating the chance for material to jam or spill as the buckets receive or discharge their load.

The head shaft receives its power through a Cleveland worm gear speed reducer and a cut steel spur gear reduction enclosed in an oil tight case. The driving motor is provided with a magnetic brake for preventing the overhauling of the loaded bucket elevator in case of power or motor failure.

The two magnetic separator pulleys were made by Dings Magnetic Separator Company. The 36 by 38 inch pulley is specially designed with extra strong and far reaching magnetic lines of force at the center of the face of the pulley and tapering off in intensity toward the edges of the face. The purpose of this is to get a good magnetic hold on all large pieces of iron which will naturally lie in the center of a troughing belt, and make certain of the removal of all such large pieces, thus protecting the crusher from damage. The 24 by 50 inch pulley is designed with even distribution of magnetic lines of force across its face, which is proper for this pulley since there are no large pieces of material passing over it. Both of the above pulleys are provided with dead sections at each end in or-

The Two Secondary Screening Units.

Return Conveyor from Bins

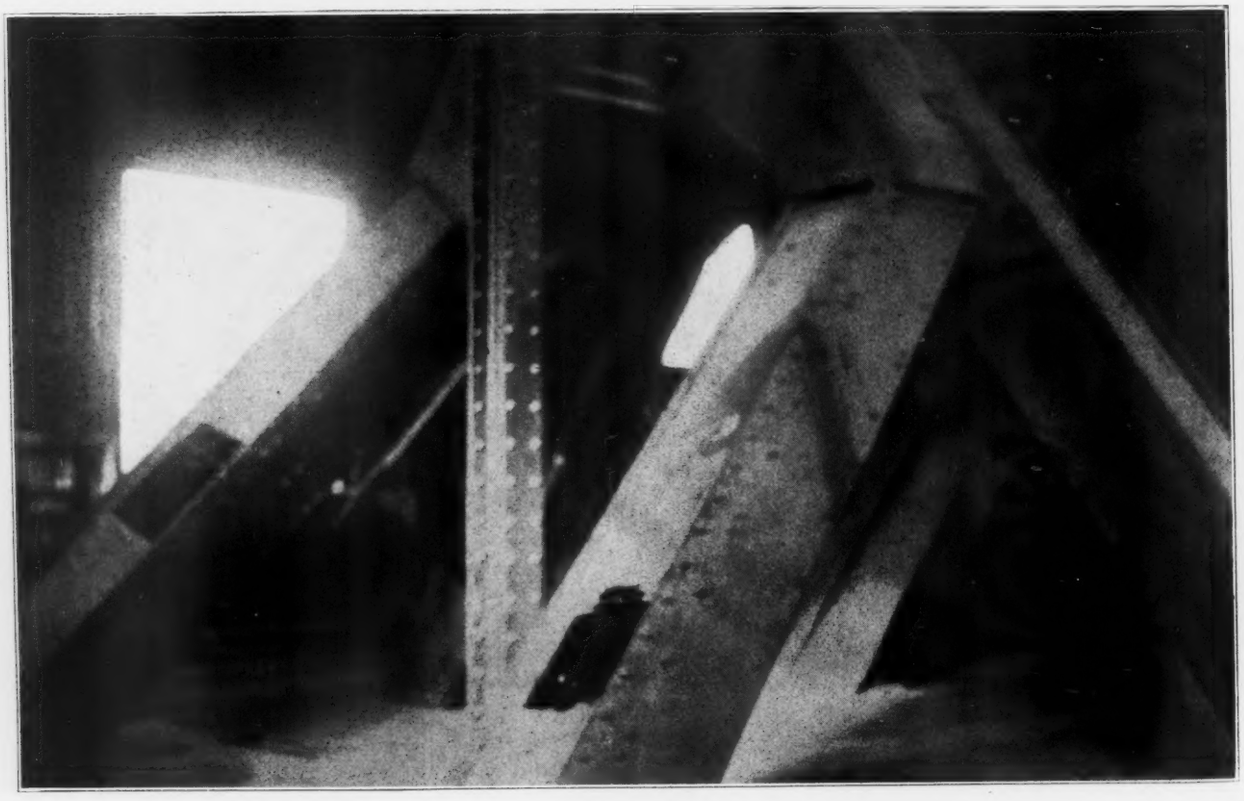
der to prevent the jumping of pieces of iron around the edge of the pulley face. For each pulley there is an enclosed safety disconnect and discharge switch fitted with pilot light which indicates whether or not the pulley is energized. The use of magnetic separators in a slag plant is very important, for by the removal of the iron, which amounts to about two per cent of the weight of the slag handled, the following advantages are obtained:

1. Recovery of a worth while tonnage of material much more valuable than slag.
2. Prevention of damage to crushing equipment.
3. Possibility of damage to crushing equipment.
4. Greater sale of slag for concrete aggregate if cause of iron streaks and stains is removed.
5. Elimination of rejection of material because of iron content.

The revolving screens are specially designed for rigidity and long wear and were built by the France Foundry and Machine Company, a subsidiary of the France Slag Company. The outer and inner jackets are made up of wire manufactured by the Buffalo Wire Works. The punched plate for the screen barrels was furnished by Johnson and Chapman.

The crusher is a number 8 McCulley gyratory crusher and is driven through an Allis Chalmers Texrope drive. A flexible drive is desirable for operating crushers and the advantages gained here include:

1. Absence of slippage.



Steel Chutes Are Used Throughout Plant for Delivering Material to Bins and Screens

2. Resiliency.
3. Large ratio of reduction, permitting the use of a higher speed and less costly motor.
4. Multiplicity of ropes, avoiding shut downs in case of breakage of one or two ropes.
5. Absence of belt splices and their many disadvantages.
6. Elimination of taking up of belts by cutting and re-splicing.

All drives except the crusher are through Cleveland worm gear speed reducers and flexible couplings furnished by the Dingle Clark Company. Speed reducers were installed in order to minimize noise, wear, and the accumulation of grease and grime, and to save floor space. The worm gear reducers were chosen in order to save floor space, as the worm gear units permit the motor to be located closely along side of the machine it is driving. The various worm gear units in the plant range in size from 5 to 60 h.p.

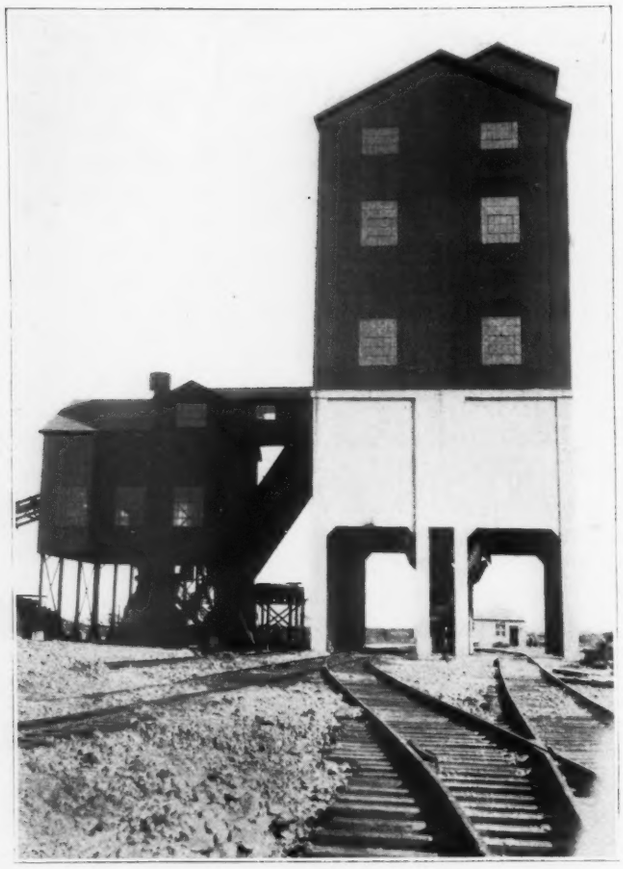
The gears (or worm wheels) of these units are of special nickel bronze, being hobbed to insure better contact, and shrunk and keyed onto a cast iron center. The worms are of case hardened nickel steel, polished and ground all over. Both the worm and gear shafts, except the 60 h.p. unit, are mounted in anti friction ball or roller bearings. The worm shaft of the 60 h.p. unit runs in anti friction bearings, but the gear shaft runs in plain bearings. The reduction gears are enclosed in a rugged cast iron housing fitted with oil ways to deliver oil to all necessary points.

The motors and controls were furnished by the General Electric Company. Each machine in the plant is individually motor driven. All motors are 230 volt direct current compound wound and ball bearing equipped. The 5 h.p. motors are of the totally enclosed, exterior fan cooled type, and all motors above 5 h.p. are of the enclosed pipe ventilated type.

The pipe ventilated motors take their ventilating air through Protectomotor air filters. The filters are mounted direct on the motor frame and are fitted with metal canopies over the top and sides, the bottom being open so that the dust that is continually being shaken from the filter cloths by the vibration of the motor will immediately fall in the clear. The filters are fitted with a compressed air connection for cleaning the cloths, and cleaning will, of course, be done occasionally. The ventilating air is discharged into the room in a downward direction at the opposite end of the motor from the intake.

The elevator motors and the 36 inch belt conveyor motor are equipped with magnetic brakes to prevent overhauling in case of power failure. It is felt by using ball bearing dust tight motors that there will be practically no serious motor troubles developing. The starting panels are of the remote control magnetic contractor type enclosed in steel cabinets. Low voltage protection and temperature overload relay protection are provided. Acceleration is by time limit rather than current limit which has been standard for many years. With

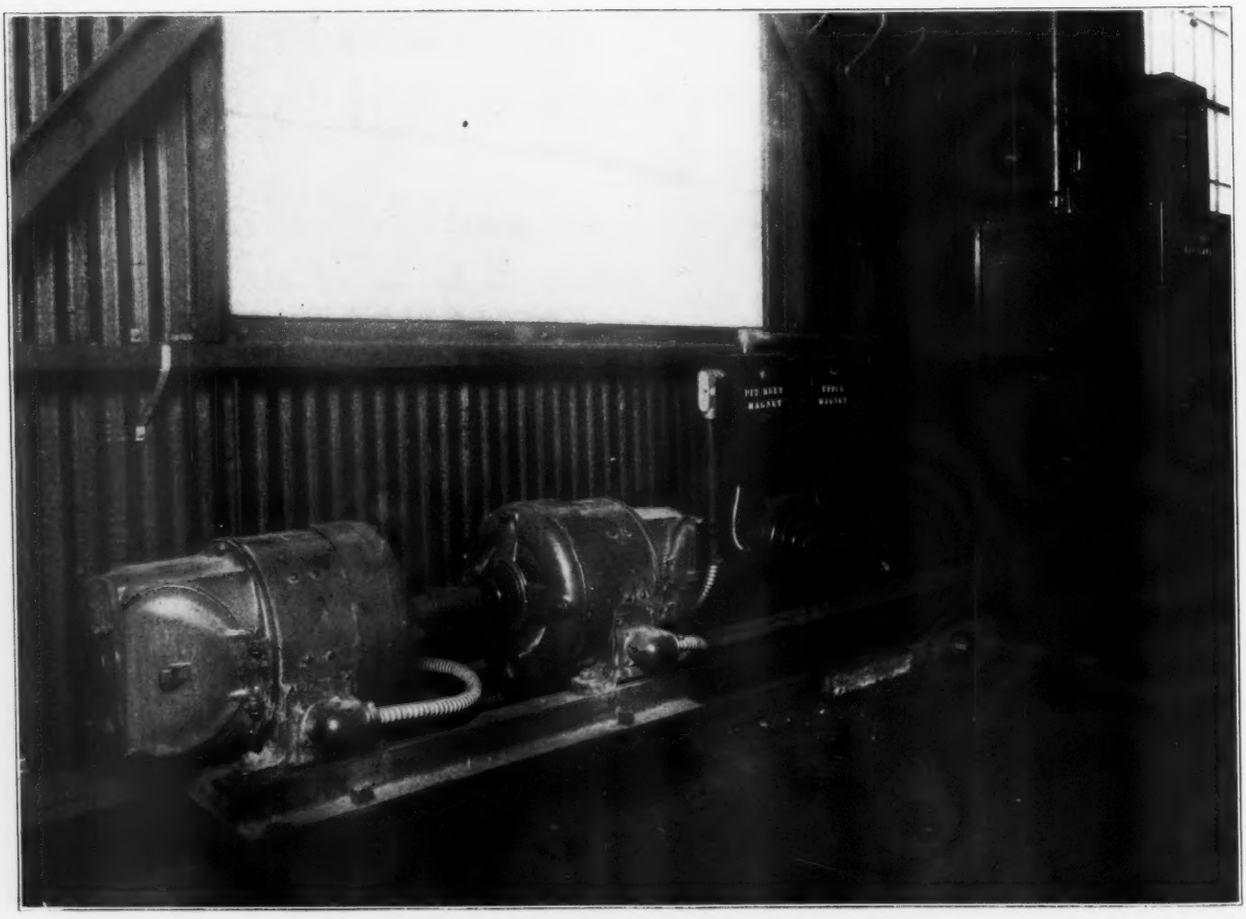
Short Belt Conveyor Discharging to First Screen



Close-Up of Plant Showing Concrete Bins

time limit, the accelerating contractors will keep coming in one after another with definite time periods between, until the motor either starts or the overload relay trips out. This is very advantageous because when ready to start operating the plant, you want the motors to start regardless of current rush through the motor, provided that such current rush is not so great or of sufficient duration to dangerously heat the motor windings, and this is guarded against by the overload relays. With the old current limit acceleration, if the motor was heavily loaded at the start, the current flow in the first accelerating point might be too great to allow the second contractor to come in and still possibly not great enough to trip the overload relay, with the result that the starting resistance would probably melt and the motor would neither start nor be taken off the line.

All motor starters are electrically interlocked in such a manner that the various machines will start up in sequence in the opposite order to the flow of material through the plant. This insures that a machine will be started when the next machine begins feeding material to it. The interlocking is also arranged so that should a machine automatically shut down or be purposely shut down, all machines carrying material to this machine will automatically shut down, thus avoiding the piling up of material on the shut down machine.



Generator and Control Switches for Magnetic Separator

The purpose of the sequence control wiring as installed in this plant is many fold, and all the desired results have actually been obtained. The control "hook-up" was worked out by D. W. Yambert of the France Slag Company. The objects of the sequence motor control wiring as used in this plant are listed as follows:

1. To start the motors one after another in the opposite order to the flow of material through the plant, so as to avoid piling up material on a machine that has not yet started.
2. To start only one motor at a time thus avoiding a large peak of demand from the power line.
3. To, in case a certain machine is purposely shut down or shuts down due to overload, automatically shut down all other machines tending to convey material to that particular machine, thus avoiding a piling up of material upon the shut down machine.
4. To provide individual jogging facilities for each machine with absolute assurance that the machine while being jogged will not start other machines or be started by other machines.
5. To provide for cutting out of the sequence while plant is either running or at rest, a machine or group of machines without disturbing the sequence of the other machines and without even momentarily de-energizing the panels of the other machines that might be running.
6. To provide, likewise, for cutting back into the sequence while plant is either running or at rest, any such machine or group of machines without disturbing the sequence of the other machines and without de-energizing the panels of the other machines that might be running.
7. To provide as a safety first measure, emergency stop and safety lockout station located in close proximity to each machine.
8. To provide for forward and reverse jogging for the crusher panel only thus insuring that the crusher can be started up even when filled with slag.
9. To provide automatic plug stopping of the crusher motor in case a solid chunk of iron gets into the crusher.
10. To provide for push button operated emergency plug stopping of the crusher motor for cases of extreme emergency.
11. To provide, for absolute safety during repair or inspection of panels, a convenient means of disconnecting from the panel all live current coming into the panel through the main wiring or control wiring.

One of the interesting features hardly noticed in the plant is a 16 ton Yale and Towne overhead rail hoist that has been installed in the crusher building to run over the crusher and practically the full length of the crusher building. This hoist will be used to lift parts from outside the plant up and into the plant for repair as well as for work around the crusher. This dual purpose is seldom utilized.

Complete safety features are being installed. All moving machinery is to be guarded by screens. A specially designed siren given a high pitch of large volume has been installed for signalling purposes. All stairways are provided with rails and are of steel framework with steel grating steps.

The France Slag Company has in this new plant a unit to be proud about. It is a splendidly designed and well constructed unit. The plant is compact but not cramped. There is plenty of room above and around each unit. The slag will be sold for aggregate in building construction and highway construction and also for railway ballast. Shipments will be made both by rail and truck. In connection with truck shipments, it is interesting to know that one set of railroad tracks under the bins is to be set in a concrete drive so that both trucks and cars can be loaded through the same gates. Fairbanks scales are used.

The officers of the France Slag Company are George A. France, president; E. H. France, vice president; and Howard E. Bair, general manager. D. W. Yambert had charge of the general design of this plant and personally worked out many of the details. G. G. Black, from the Toledo office, is district superintendent of the territory including this plant. E. L. Adams is resident superintendent and was in charge of the plant construction work.

## Construction in Montreal Sets Record

Building permits issued in Montreal, Canada, during August totaled $19,068,000 and established a new record for all time, according to Consul General Albert Halstead, Montreal. This volume is greater by $3,500,000 than the total issued from January 1 to July 31 of this year. The total value of published building permits issued in 1926 was $31,700,000, or $2,870,000 less than have been issued already this year. This great increase for the month of August is the result of the three following permits: Sun Life Insurance Co. building, $12,000,000; Bell Telephone building, $3,000,000; and the new Jesuit College to be built at Cote des Neiges at a cost of $1,000,000. In addition to this, however, residential and industrial construction has kept pace with last year's construction.

## Building Industry Holds First Place in New Zealand

Recent statistics show the building industry in New Zealand, in respect to the number of persons engaged and the salaries and wages paid, to be the largest in the Dominion, being closely followed by the saw-milling industry, according to American Trade Commissioner Julian B. Foster, Wellington. Salaries and wages paid in the building industry for the fiscal year 1925-26 totaled about £2,430,000 as compared with £2,320,000 for the sawmill industry.

# WHY SHOULD THE SMALL PLANT BE INTERESTED IN SAFETY?*

By W. H. Weitknecht,
Superintendent, Lehigh Portland Cement Company

BY SMALL plants, I mean that plant which has not the opportunity, does not command the means of employing a full time safety man, but must depend upon the work that is done within the organization by the management cooperating with the safety committees of the plant. In the first place, what constitutes real safety? You have heard much about the two principal factors or elements in accident prevention—the mechanical element, consisting of safe places, tools, equipment and safety appliances, and that indefinite, inconstant human element that has to do with the mental attitudes and the mental aptitudes of the workmen. I wonder whether you have come to the same conclusion that I have, that there frequently appears to be too definite a distinction made between these two factors. I want to try to correlate them to show their relation one to the other in attacking that problem from the angle of responsibility.

It is readily conceded, I think, that the matter of mechanical equipment, of safe mechanical equipment, is largely if not wholly a matter of the ownership and operating management. They owe it to the workmen to furnish that. Does their responsibility largely cease when they have a well equipped plant, safe in all its mechanical equipment and appliances? Is it now to be turned over to the workman, and personal injuries resulting from so-called accidents henceforth to be the result of carelessness or bad practices on the part of workmen? Is not the management responsible for the supervision of the practices and performance of employees? Quite as much as it is responsible for purchasing the proper equipment and safeguarding it? Is not the foremanship throughout the plant the responsible expression of the ownership and management? Is it not true that the employee is frequently not adapted to the employment that is offered him? Is it not true that either inadequate or frequently incompetent instructions are given to the employee? Is it not likewise true that the very foremen, who are the expression of management, are guilty of practices either as a result of carelessness or incompetence that is imitated by their workmen? Am I placing too large a responsibility on the management when I draw attention to these facts? What are the responsibilities of workmen? There are natural deficiencies and delinquencies among properly instructed workmen which cannot reasonably be foreseen by a competent supervising management. For those the workmen are largely responsible; but they are comparatively few in a well managed, well supervised plant.

Safe practices and safe places constitute the sum and substance of real safety, for both of which management is largely responsible. In proof of that I wish to cite the work that was done by the various cement plants (mostly member companies of the Portland Cement Association) when first the work of accident prevention was suggested to the industry—the placing of safeguards on mechanical equipment, the determining of safe places throughout every department of the mills and quarries, without any corresponding advantage or progress in the matter of accident prevention. Accident investigation gave us the clue and in nearly every instance it could be said not only that the workman should reasonably have foreseen the condition that resulted in his injury or near injury, but that the supervising management, the foremanship in that department, should likewise have foreseen it and prevented it.

After we began to place individual responsibility, personal and mechanical, on the foreman of every department, we commenced to reduce personal injury accidents, and we have continued to proceed along those lines by assuming the responsibility for practices and performances ourselves, the result was that soon a cement plant operated throughout a calendar year with but very few hours of lost time per hundred thousand man-hours employed. That was followed the next year by a perfect record, where a cement plant operating with (I think) 150 employees continued throughout the calendar year without a single lost time accident in an industry prominently known and conceded to be rather hazardous. The succeeding year two plants went through the entire year without a single lost time accident, each plant having more than 100 employees. That was followed by two plants, one of which employing over 500 men, operation through the entire calendar year of 1926 without a single lost time accident. Proceeding on that theory, that the management must assume the responsibility for much of the practices, and trying to discharge that responsibility by careful supervision, what will you say when I inform you that to date in 1927 there are 23 cement plants in the United States and Canada, each employing from 100 to over 700 men, which have not had a single lost time accident.

According to the way they are running now, we hope that at least 20 of those cement plants will

*Presented before the National Safety Congress, Sept. 29, 1927, at Chicago, Illinois.

complete the calendar year of 1927 without a single lost time accident. That is an accomplishment which is the result of what? The assumption by the management that it cannot pass the responsibility, pass the buck, in other words, down to the rank and file for careless practices, that it must give the working organization careful, safe practice habits, and that those must be developed only under careful supervision.

Does the matter of accident prevention assume a somewhat different aspect to you as managers of small plants, now that I have told you what the results are from following that line of thought? Are you willing to go home and put into practice the best efforts at supervision and management that you can think of, in order to discharge that responsibility for the personal injuries that occur in your plants, including the fatilities? If you can get that point, if you can take that home with you, if you will practice that, you will have made a real start in real accident prevention.

What has been done in a hazardous industry like the cement industry can be done in any other industry if you will attack the problem with the same spirit and with the same understanding. That's the phase of it that affects the industry itself, the plant itself, in the prevention of accidents. The economic side, the directly economic side I shall just barely touch on because there is much dispute with reference to it.

What do you think these cement plants will do when they find that they can run year after year, as they are going to, with just minor lapses so far as their compensation or liability are concerned? They are going as far as is possible for them to go in states where they are permitted to carry their own insurance, and the best risks which the insurance companies have will drop out. What will be the natural result? As this scheme of accident prevention gains momentum, the industries that do real accident prevention work will drop out as customers of insurance companies and become self insurers.

What is going to happen in the matter of workmen's compensation and liability rates to those who remain as the customers of the insurance companies? Double, treble, quadruple—I shall not attempt to indicate the manifold increases that you may expect and that are bound to happen. If you do not want to be among that class of industry which pays a prohibitive compensation or accident liability premium, you had better begin on the matter of real accident prevention.

There is a far more important reason why the small plant should be interested in safety, for real safety properly inculcated will express itself in habit. No individual can be a safe man in an industrial plant at his employment, and set the garment of safety aside when he leaves the property of the employer. It becomes a matter of habit with him just as much as it does to get up in the morning at five o'clock and before the alarm rings which he has set the night before. All of you have had that experience, I presume, setting an alarm to get up at a certain hour in the morning, and following that practice for several months, only to find that in a very short time you will awaken before the alarm goes off. You do it as a matter of habit, governed by the subconscious mind. That is a problem for psychologists to answer. You will shift the gear on your automobile after you become familiar with the operation of it, without thinking in detail what you are doing. You apply the brake automatically as occasion arises. Your actions are governed unconsciously. You cannot do two things consciously at the same time, but still you can do a number of things at the same time, while your mind is consciously employed at something else. That is the development of habit.

So will habit operate in connection with the development of safety in a plant; it will continue to operate after the man has left the plant. He sees a dangerous condition, he recognizes the danger and he does not rest until either he has remedied it or has called the attention of someone whose business it is to remedy it. That is another thing you want to tell your employees. If they want to be real safety men, they must follow that line of action, for if they don't, if they consider a hazard not a part of their business because it is outside their plant, they will again be like you when you hear that alarm go off several times in succession and do not get up. It will be but a very short time until you will not hear the alarm. You will have destroyed that unconscious government; so with the development of habit and its subsequent destruction. That's what I consider the sum and substance of real accident prevention work.

How does that apply in the community? Are we facing any community problems, especially in the smaller community, in the smaller cities? I heard something this morning that the Safety Commissioner of New York City said eleven years ago in discussing traffic problems of the larger cities. He made the statement that some particular point in traffic regulation did not apply to smaller cities since cities of 250,000 population had no traffic problem. Think of it, eleven years ago cities of 250,000 population did not have a traffic problem—and you know that was largely true.

Is there any need for the development of safe practice habits in industry? Is there any need that safety habits shall be so developed that they will express themselves in the community at large? My belief is that the matter of public safety can be accomplished in no way more quickly and effectively than if we can enlist the active support in accident prevention work of every small industry

throughout the United States and Canada. If it is true that the majority of workmen in industry are employed in plants of 300 men or less, what more important work can the management of such small industries do than to start active, effective accident prevention work in their plants? It will have a far greater effect, will be more far reaching, than the best accident prevention work that is done in large industries.

Take in connection with this fact, the figures from the workmen's compensation bureau, that some industries have proportionately more accidents. Insurance companies now consider them much greater risks than the larger industries employing many hundreds or many thousands of men. Is that due to the fact that there are larger hazards in the smaller industry? No. The reverse is really true. There are greater hazards in the larger industries, but the reason we have less personal injury accidents in the larger industries is because effective accident prevention work is being done.

In my opinion the obligation rests upon the management of small industries to help the safety movement by inculcating safe habits among their employees. The big thing that you, as managers of the small industries, can do is to start preventive measures, and if an ounce of prevention was ever worth a pound of cure, it certainly is in preventing personal injury accidents, and no place will be as productive of good results, no soil so fertile, than right in your own small plant. It will relate itself to the schools; the children in the home will be taught by the father. That instruction will come as a result of the instruction he receives in his plant. Many a boy and girl going to school will be saved as the indirect result of your accident prevention work in your industry. Many a boy and girl, yes, many a man and woman, will obey the traffic regulations because they have been taught that it is the wise and the right thing to do. They are in a mental attitude to obey. They don't want to run past the red light. They have been taught the reasonable thing to do and they have acquired that habit, for we are all creatures of habit, and as we perform in our daily life in one way or another, so we perform in moments when we think less about ourselves or about anybody else. We are governed by the law of habit, which is a development of the governing function of the subconscious mind.

How many of you have been mentally preoccupied when you came to a traffic light and have run past it without noticing that the red was turned against you? Mental preoccupation. That's one of the things you must guard against. You weren't controlled by any unconscious governing body within you. Your mind was active on something else and you ran past it. You hadn't formed the proper safe practice habit with reference to stopping at those signals.

If you can in a measure agree with me that the work of accident prevention in the small plant can thus be related to public safety in your community, who is there to deny the great possibility for good? Who is there who will not say that the effort is not worth while?

## Hold All Ohio Safety Congress

Crushed stone producers, coal operators and cement manufacturers from all over Ohio will gather in Columbus November 9 and 10 for a conference on safety in quarries and mines to be held in conjunction with the All-Ohio Safety Congress arranged by the Division of Safety and Hygiene of the State Industrial Commission. E. E. Evans of Toledo, president of the Ohio Crushed Stone Association and chairman of the section on quarries and mines, announced today the list of speakers. Harry Hamm, Cleveland Builders' Supply Company, Cleveland, will give a talk on "Industrial Compensation from the Standpoint of Industry." A. J. R. Curtis, assistant to the general manager of the Portland Cement Association of Chicago, will speak on "Safe Practices as Applies in the Cement Industry." "The Biggest Job in the World" will speak on "Safe Practices as Applied in the assistant to the executive secretary of the National Coal Association, Washington, D. C. A first aid demonstration will be given by Jay Thompson, executive secretary of the Toledo Safety Council. It is expected that eevry county in the state will be represented at the conference.

## Monster Power Show Planned

The National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York, December 5th to 10th. The coming power show is the sixth to be held and promises to be the greatest success, which is easy to understand in a country which puts such a premium on novelty and improvement. But the coming event is of greater importance than its predecessors for this exposition gives under one roof an unsurpassed opportunity to study all the types of mechanical equipment that American manufacturing may use to advantage. Over 500 concerns will be represented and their showings will include those of machinery for power generation, heating and ventilating, refrigerating for large industries and office buildings. There will be many displays for measuring and recording time, pressure and volume. There will also be outstanding examples of modern machine shop equipment material and woodworking machines and an especially noteworthy collection of exhibits of power transmission equipment.

# DUBUQUE STONE PRODUCTS OPERATES QUARRY WITH 200 FOOT FACE WITHIN CITY LIMITS

OPERATING a 200 foot bluff limestone quarry within a city of 50,000 people with residences around the property and with a tough, solidly packed deposit is a problem to worry any crushed stone company. Such a problem faces the Dubuque Stone Products Company of Dubuque, Iowa, every day. However, this company carries on the quarry operations successfully in spite of the attending difficulties with a plant capacity of 2,000 tons daily.

The property, which consists of about 15 acres of which approximately 5 acres are now opened up, lies on the Iowa bank of the Mississippi River at a point directly opposite the place where the Illinois and Wisconsin boundary lines meet. It is bordered on the north by a 200 acre public park, known as Eagle Point Park, overlooking miles of the Mississippi River north and south and the surrounding bluffs and scenic splendor. On the east is the Mississippi River; on the west, a much traveled main concrete automoble highway leading across the Iowa-Wisconsin high bridge; and on the south, a thickly settled section of residences and business houses. The quarry breast or face runs from a height of 132 to 200 feet above the floor and is about 880 feet long. At its highest point it is but a scant 60 feet from the plant and general offices of the company as well as numerous private residences. This makes the blasting operations extremely difficult and hazardous, especially so as the

P. M. Nauman

Plant of Dubuque Stone Products Company

J. C. Collier

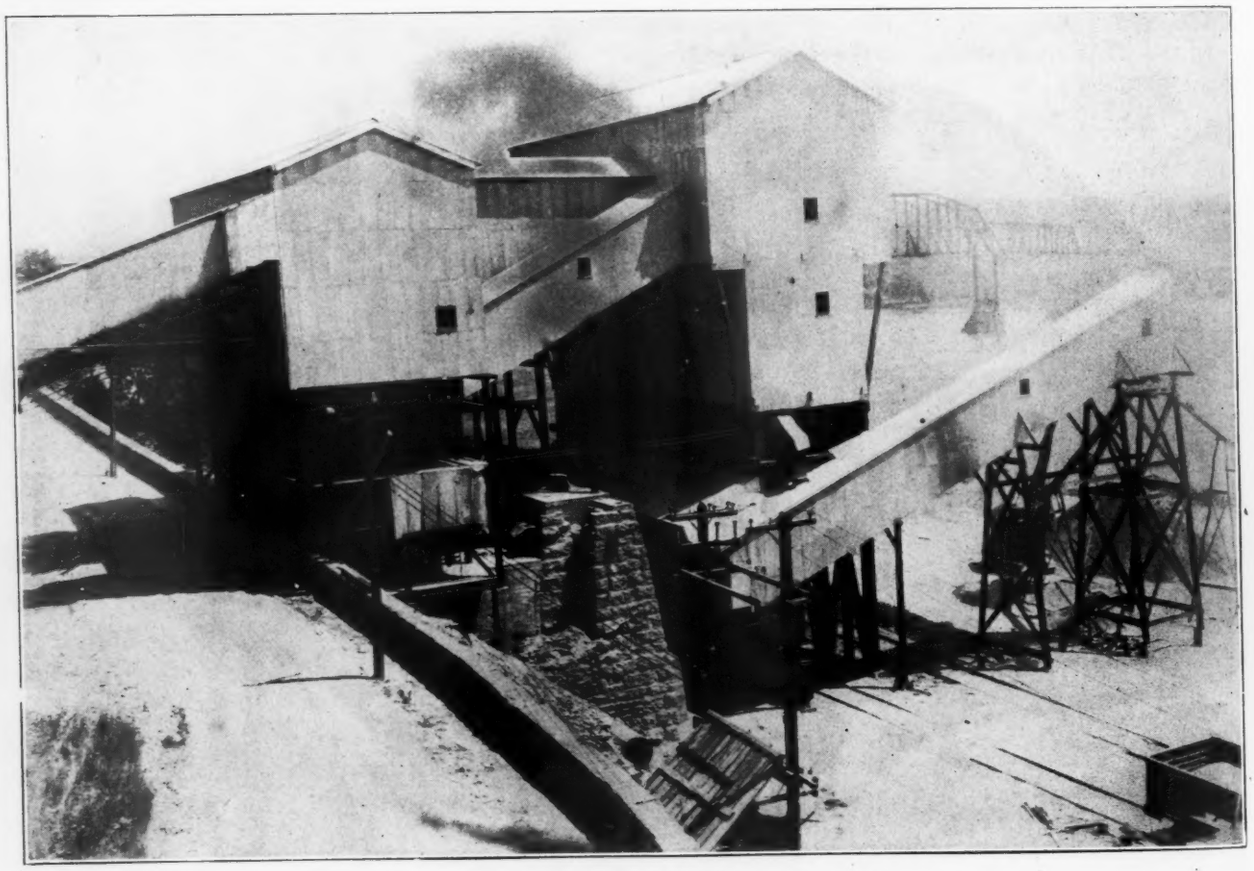
rock is one of the hardest formations in the state and practically one solid mass from top to bottom of the quarry.

### Analysis of Dubuque Stone

| | |
|---|---|
| Specific Gravity | 2.72 |
| Weight Per Cu. Ft. | 169.00 |
| Absorption in Per Cent | 1.0 |
| Absorption in Lbs. Per Cu. Ft. | 1.7 |
| Abrasion Test | 4.0% |
| French Coefficient of Wear | 10.0 |
| Coefficient of Hardness | 15.2 |

The rock is covered with an overburden averaging about four feet which is removed to ravines nearby by means of trucks loaded by a Thew gas shovel equipped with a half yard Hayward dipper. The drilling and blasting is contracted out on a footage basis. Six inch holes are drilled to a depth averaging 154 feet which brings the holes about four feet below the working quarry floor level. This is done to insure an even depth in the operation. These six inch drill holes are spaced sixteen feet apart and twenty-five feet back from the quarry face, and usually six to eight holes are blasted at one time, depending on conditions. An average of 1,000 pounds of 50 per cent Du Pont gelatine dynamite is used to each hole and this is fired by means of Cordeau-Bickford fuse.

Secondary drilling on the large pieces is done with Denver rock drills, and the rock is blasted to



Close-Up View of Crushing and Screening Plant

a size which can be handled by the primary crusher. A number 460 Marion electric shovel equipped with a half yard Hayward dipper loads the rock into either of two 7½ ton Mack trucks equipped with special dump bodies made by the Easton Car and Construction Company. These trucks (each with a capacity of between 500 and 700 tons per 10 hour day) haul the rock an average distance of 350 feet and discharge to a hopper which feeds a 30 inch Traylor gyratory primary crusher driven by a 150 h.p. General Electric motor. Chicago Pneumatic air hoists are used in dumping the material into the hopper. This truck unloading operation is shown very well in one of the illustrations. The crushed stone discharged from the crusher drops to a 30 inch Goodyear belt conveyor 76 foot centers, driven by a 15 h.p. General Electric motor, which delivers the product to a 60 inch by 16 foot Allis Chalmers rotary scalping screen. The stone of a size below ½ inch drops to an 18 inch Goodyear belt conveyor 30 foot centers, driven by a 15 h.p. Allis Chalmers motor, which delivers the material to a battery of six vibrating screens, five of which are Universals and one a Leahy. These screens are driven by a 15 h.p. motor through Allis Chalmers Texrope drive. These screens separate out the ⅜ inch stone which falls through chutes to storage bins, being later sold for road surfacing stone. The fines and dust pass through chutes to other storage bins and are sold as agricultural lime.

G. D. Rose

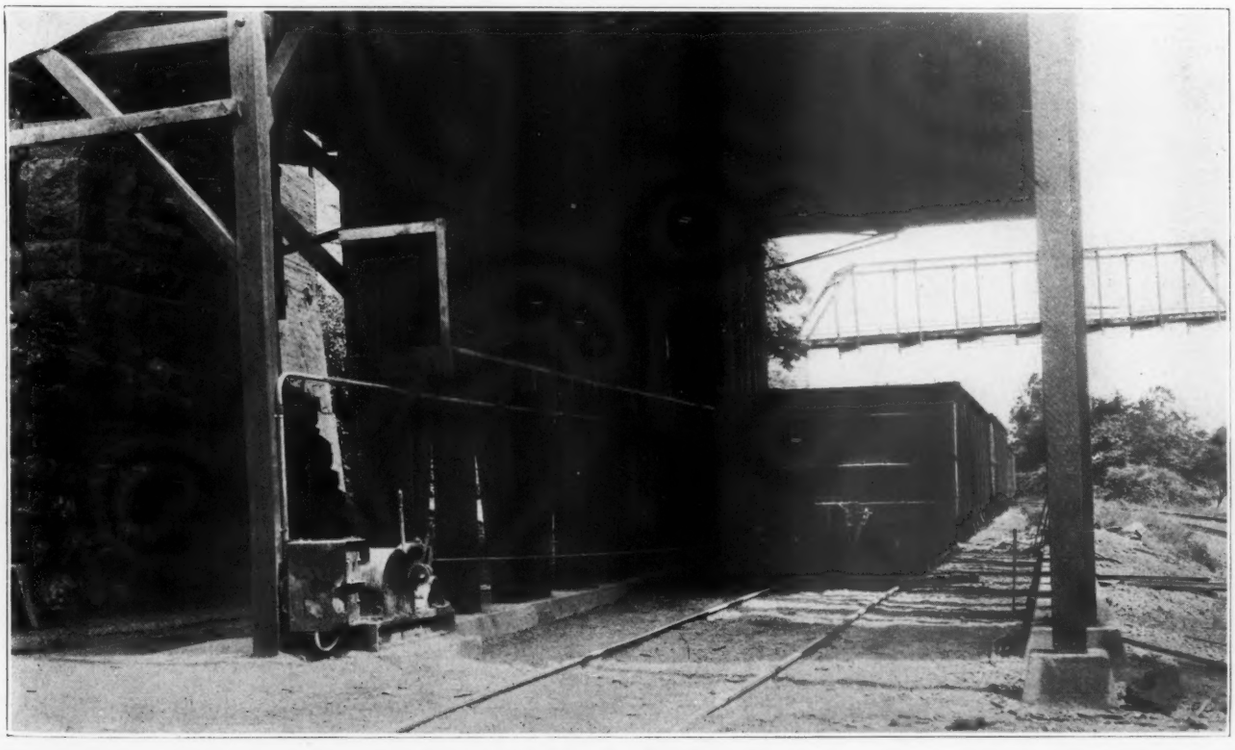
The stone from 2½ inches down to ½ inch passes from the scalping screen to a 26 inch Austin bucket elevator, 35 foot centers driven by a 25 h.p. Allis

Loading Stone in Quarry Into Trucks

Partial View of Quarry

**Truck Discharging to Primary Crusher**

Showing Method of Forming Outside Storage and Method of Reclaiming



Spotting Cars for Loading Under Bins

Part of the Screening Plant

Chalmers motor, and is carried to a 60 inch by 24 foot Allis Chalmers sizing screen, driven by a 25 h.p. Allis Chalmers motor, where it is sized and delivered by chutes to storage bins. The oversize from the scalper drops to a number 7½ Austin gyratory crusher, driven by a 75 h.p. General Electric motor which discharges to a hopper that feeds the material to a 30 inch Stephens Adamson belt conveyor driven by a 15 h.p. motor. This belt conveyor delivers to the sizing screen where the material is sized and dropped into the storage bins. The rejects from the sizing screen drop to a 16 inch Goodrich belt conveyor 63 foot centers driven by a 5 h.p. motor which delivers to a number 5 Austin gyratory crusher driven by a 50 h.p. motor. The discharge from this crusher is delivered back by chute to the sizing screen where it is sized and chuted to storage bins.

The railroad cars and trucks which pass directly underneath these bins are loaded through 20 inch by 20 inch bin gates, and it takes but 7 minutes to load a 50 ton standard gondola with either crushed stone or agstone. Cars are spotted by means of an electrically operated Clyde drum type car puller which has a capacity of pulling 20 loaded cars.

The plant is located on the Chicago, Milwaukee and St. Paul tracks, and on the Mississippi Water Barge Line, and under a switching agreement is served by the Illinois Central, Chicago Great Western, and Chicago Burlington and Quincy railroads. The sidetrack serving the plant is 1,000 feet in length and accommodates from 40 to 45 cars, while another sidetrack serving stock piles is 400 feet long. The latter was installed as a protection to the customer who needs material when the plant is not in operation, and stock piles material is loaded with a ¾ yard Thew gasoline shovel. Material from the plant is shipped to various parts of Iowa, Illinois and Wisconsin, where it is used for road construction, foundry flux, building construction, rip rap, and agricultural purposes.

The demand for agricultural limestone is growing by leaps and bounds, and Iowa farmers are just beginning to realize that unless their soil receives the necessary lime they cannot expect to grow clover. It has been definitely proven in dry seasons that limed soil carries moisture much longer than soils not so treated. In addition to the crushed stone business the company produces a very high grade dolomite wood burned lump lime which is broken up in the extreme north end of the quarry, handled and loaded entirely by hand and hauled to

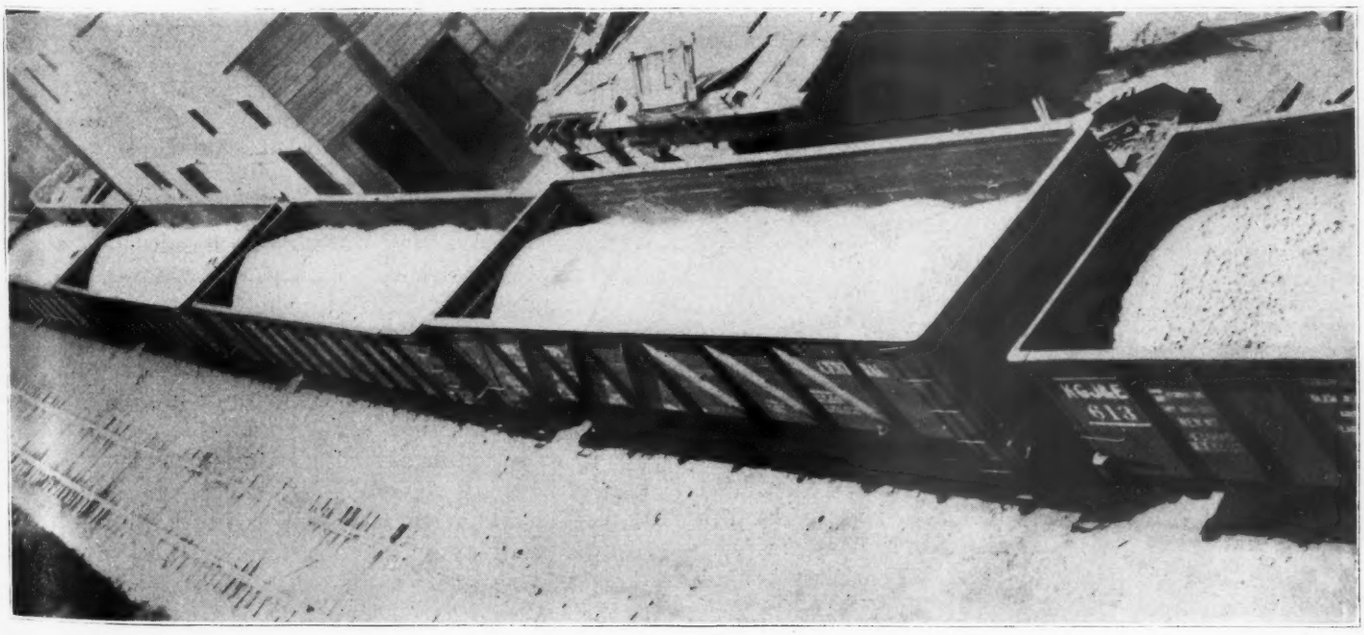
Looking Across the River Showing Plant on Bank

the kilns in Chevrolet trucks. The kilns, of which there are two, are wood fired, and the amount of lump lime produced is only a minor factor of the plant operation. The company conducts both a wholesale and retail yard for builders supplies, deliveries being made by means of Mack and Indiana service trucks.

The officers of the Dubuque Stone Products Company consist of G. D. Rose, president; J. C. Collier, vice-president, and P. M. Nauman, secretary-treasurer and general manager. An interesting experience in visiting the operations of this company is encountered when the splendid spirt of cooperation and good will existing among the employees and in their associations with Mr. Nauman is observed. Conditions here are a practical example of what results can be obtained by promoting a feeling of confidence among the employees.

## New Zealand Building Sets New Records

Reviewing construction work throughout New Zealand for the period 1926-27, the Government statistician reports an outlay of £11,019,389 constituting a new record for the Dominion, according to Trade Commissioner Julian B. Foster, Wellington.



Trainload of Material Ready to Move

# HOW AGSTONE IS SOLD OUT OF SEASON

By A. R. Ebersol,
Manager, Perry County Limestone Company

HAVING solved, as we believe, to a large extent the problem of all year agstone production and distribution we believe producers and consumers generally are interested to know our methods. Our plan and methods are not a sudden, new lucky scheme but a worked out plan based on knowledge of and experience in the game as tried out without these plans and methods and lack of which has brought failure to nearly all local plants endeavoring to live on agstone production alone.

The writer has been a farmer and knows the farmer's viewpoint. He has been at one time connected with a manufacturer producing pulverizers and other equipment and has, during that time, installed plants for prospective producers of agstone who have tried to make successes of local plants. He has operated several of these plants for several seasons for their owners in New York State, also was part owner for a season of a new local plant in the best agricultural section of Pennsylvania.

The principal reason for failure of the many local plants attempted and some large commercial plants is "the short periods of consumption." Very short in the spring, longer in the fall but not very long, leaving most of the year with little or no demand.

For the benefit of the inexperienced, let us relate the bare facts as the writer has learned them by costly experience, as well as by observation of others who paid to learn them. The experience of Mr. A. serves as an example. Mr. A was casting about for some paying business. He noted the price of agstone. The cost to the farmers. He talked about starting a grinding plant. Very many seemed to want lime. They mentioned the tons they should have. Mr. A., adding these figures, felt he had practically sold so many tons if he started up. He writes for catalogs, notes the tons per hour, the power required and figures the daily income by the tons capacity times the price per ton to farmers. Looks like a money maker. Salesmen call on him and one sells him a plant. When it arrives and is set up ready to operate the best season is over. He fills his bin after finding that to quarry and move the stone to the plant is much more of a job than he expected. He has no experience, no drilling equipment, and the work is much harder than his men are accustomed to. He finds his product not first class. Too coarse, say the farmers. Farmers don't call for lime, even those who urged the plant to start. They are behind with their work and dont get to the lime. Or they get a load or two and that is all they find time for. Or they find money scarce, etc. So that the many prospective orders turn out to be a very few real orders. Mr. A finally waits on the coming season. Yes, say the farmers, we will haul as soon as we are ready to sow. Very little moves until time to sow. Then for a few weeks all goes out that Mr. A can produce by his crude methods. Then the season is over. The result is much expense through waiting, living costs and machinery to pay for and little actual money received. He finds he should have scales, a bagging outfit, a bigger storage to fill up for the next rush season. He finds the product less desirable as the machinery wears or gets out of adjustment, etc. He finally gives up. Various things yet the blame.

Being a new kind of industry no one could foresee the drawbacks, much less overcome them as they appeared. Yet it is apparent that the price prevailing direct to the farmer makes the agstone business desirable if these drawbacks were overcome. Before starting our operation, we felt that since the writer had the experience in production and equipment we could secure the right kind of plant and were sure of a fine desirable product. With a proper method of delivery, either bulk or in bags at reasonable prices, if we could find a way to get farmers to lay in their supply out of season, we could make a success of the agstone business and be a distinct benefit to the community. We did find a way to get farmers to buy out of season. We proved our plan feasible by getting signed orders for several months' output to be delivered out of season. This was accomplished before we started our plant.

The several factors necessary for success then are (1) a fine uniform, desirable product; (2) the right power and machinery to make such product; (3) proper facilities for quarrying and handling the stone; (4) proper facilities for storing a supply in the dry and measuring or weighing out to customers in bags or bulk; (5) a system of delivery at fixed reasonable rates; (6) a salesman to visit every farmer and take definite orders; (7) and a definite inducement to make farmers buy out of season.

To get farmers to buy out of season we not only make concession from the regular price but also reduce the rate of delivery some. We offer to take notes up to 6 months and charge no interest or give a liberal discount for cash. If they have no suitable storage place we make and sell at cost cheap bins of 3½, 8, 11 or 20 tons' capacity which can be set at corner or end of field and filled with agstone. A roof keeps the material dry enough to

*(Continued on page 104)*

# CAREFUL DESIGN RESULTS IN ECONOMIES FOR SAND AND GRAVEL PLANT

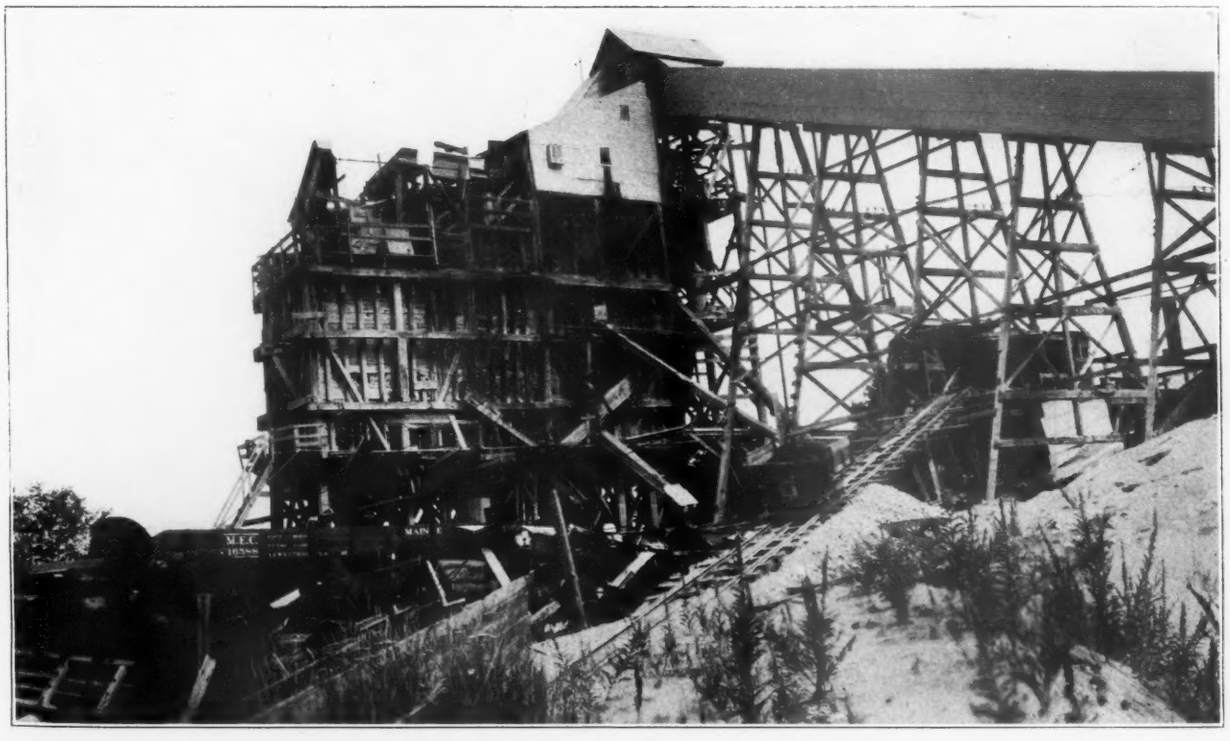
**By George Ransom**

AMONG its various operations the Maine Sand and Gravel Company has a plant at Leeds Junction, Maine, which is distinguished, among other things, for the importance of many of the jobs for which it has supplied material. Among these may be mentioned the million dollar bridge of the Maine Central Railroad crossing the Kennebec River at Waterville and the Central Maine Power Company's dam at Skowhegan. Another, and perhaps one of the most spectacular jobs of its kind ever done, was the immense dam of the Central Maine Power Company at Lewiston, Maine, known as the Gulf Island dam, which was built by the M. C. Tuttle Company, of Boston. This job was completed in ten months during the winter and spring of 1926 by working night and day. The Maine Sand and Gravel Co. supplied 185,000 tons of washed, screened sand and gravel for this job and maintained a storage of about 10,000 tons at the dam all the time. The significance of this will be appreciated when it is realized that this meant keeping the gravel plant in operation with the temperature sometimes 20 degrees below zero Fahrenheit when it was necessary to blast through three feet of frost.

Just at present this plant is engaged in furnishing all of the sand and gravel for the three million dollar bridge across the Kennebec River at Bath, Maine, with piers extending 100 feet below the surface of the river. Of course a great deal of material has been furnished and is now being delivered for state highway work, including most of the large jobs between Portland and Bangor. An interesting feature of the Leeds Junction sand is that it has shown a strength of approximately 120 as compared with Ottawa sand at 100.

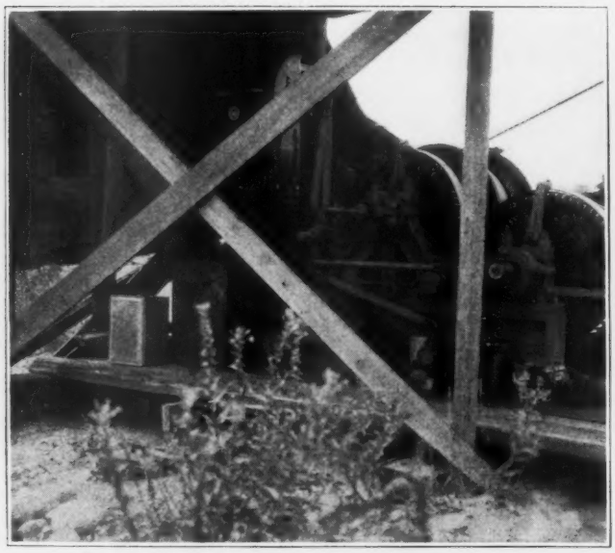
View of Plant Showing Conveyors and Transfer House

Naturally a plant and a personnel which does work like this is interesting. The plant itself was designed and erected by the Conveying Weigher Company. It is the largest sand and gravel operation in the state and it is very free from large stones and boulders. Excavating is by an Erie steam shovel which, as in one of the illustrations, loads the material into 5 yard Western side dump cars. A Baldwin locomotive pulls trains of four

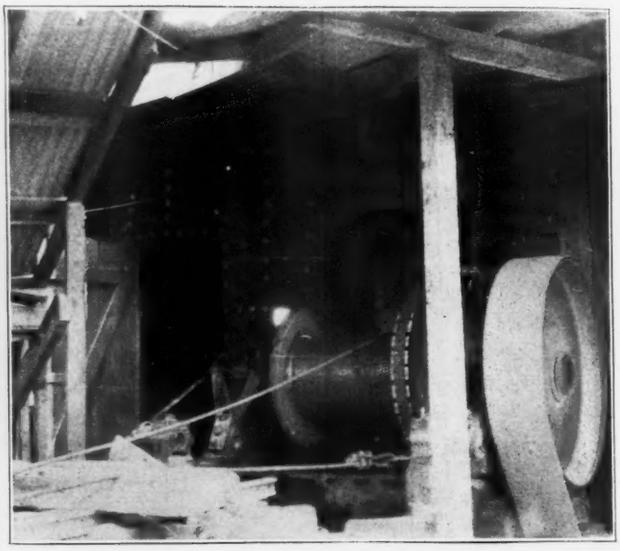


View of Plant Showing Car on Incline from Hopper to Grizzly

Shovel Loading Material in the Pit



Electric Hoist Operating the Drag Line Scraper



Hoist for Car Operating on Incline.

General View of the Pit

cars up to the hopper for dumping.

Material is taken from this hopper up to the plant in a 2 yard Western dump car. It is discharged from the hopper by means of a clamshell loader. The car is pulled up the incline by an electrically operated hoist, equipped with American Steel & Wire Company wire rope, and the work has been so well systematized that fifty trips per hour are the regular schedule. The man at the hopper signals the hoist engineer by means of a bell.

At the top of the incline the car is dumped into the grizzly by means of a dumping rail. Material which passes through the grizzly drops into a hopper from which it is fed by a Link Belt reciprocating feeder on to a 24 inch belt about 75 feet between centers. This belt, which was furnished by the Conveying Weigher Company, has the excellent record of seven years of continuous service, summer and winter. It is still going strong. The material is taken by this belt to the transfer house where the direction is reversed and it is carried up to the sizing screens at the top of the plant by another belt conveyor of similar width and make, but in this case 149 feet between centers.

The stones which do not pass through the grizzly slip off into a number 5 McCully gyratory crusher from which they pass through a chute to the belt conveyor and thence to the screens with the other material. There are four cylindrical revolving screens, each of which delivers a particular size. Washing, of course, takes places at this point and the sand is carried into Link Belt settling tanks. The tailings from the last screen pass through chutes to a number 25 Kennedy gearless gyratory crusher and from it back to the conveyor system.

The Primary Crusher

Drag Scraper for Handling the Sand Washings

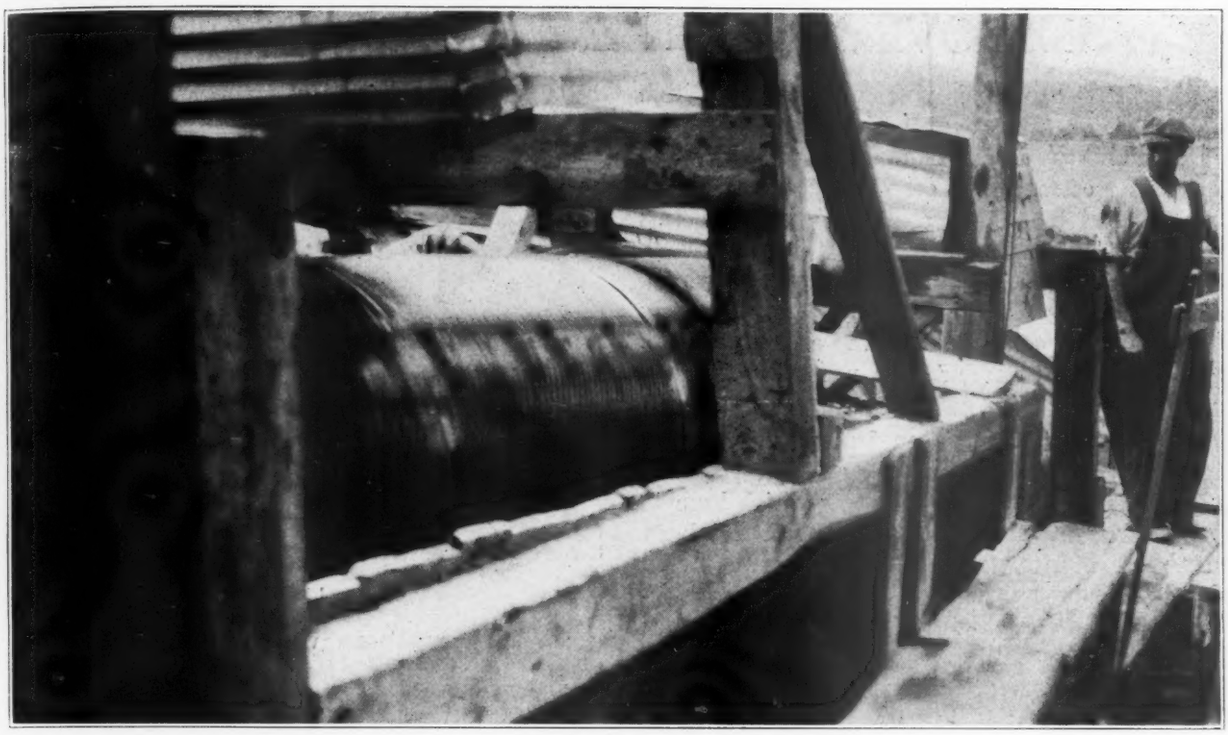
Train of Pit Cars Dumping Into Hopper at Foot of Incline to Plant

This gives the cycle of operations but there are several important details which have not been mentioned and which have an important bearing on the practical outcome.

One of the most important of these has to do with the sand washings. The overflow from the settling tanks and from the screens is run out into an old section of the pit from which the water drains back into the pond. These washings contain a considerable amount of good sand which is reclaimed from time to time and rewashed. To do this a Sauerman dragline scraper and a Sauerman electric hoist have been installed by means of which the washings are scraped into a hopper which discharges into the dump car operating on the incline to the plant. All machinery is driven by motors and the whole plant, including the pit, is provided with electric lights for night operation which has been carried on quite extensively.

The water supply comes from a good sized pond on the property and it is fully adequate for all needs. The Worthington rotary driven pump, driven by a G. E. 75 h.p. induction motor, is located near springs which keep the water from freezing in winter. This also means that the water is warmer than would otherwise be the case and

Bins Showing Freight Cars Loading on Each Side



One of the Sizing Screens

does not freeze so quickly in cold weather. Of course, during the extreme cold waves in winter washing is impossible but it is done in all ordinary weather in spite of the fact that the temperature is far below the freezing point.

Enough stripping is done in autumn to carry over the winter. The Erie shovel is used for this. When it is necessary to blast, dynamite is used. In fact, the way in which winter operation is carried on is most remarkable. There is a repair shop where all ordinary repairs are made. The forge has a Champion blower and among other tools used there is a Black and Decker portable drill.

The bins are so placed that they have railroad tracks, a spur of the Farmington Branch of the Maine Central Railroad, on each side. These tracks have a slight grade so that when the cars are pushed to the upper end they can be let down to the bins by releasing the hand brakes. Each track holds eight cars. The bins now in use are made of wood but during the coming season they are to be replaced with concrete bins. The deposit of gravel here amounts to several million tons and several million more may be added when desired.

The normal production of the operation is 1,000 tons per day of nine hours. The full crew for accomplishing this is 16 men. To do this means not only that the machinery functions well, but also that it is well taken care of and that each man knows his job. In the last analysis probably the superintendent, Mr. Guy L. Nichols, deserves the most credit of any one individual, for it is he who has to plan all the practical details and see to it that they are such that they can be carried out even under the trying conditions of winter operation. Apparently the railroad is helpful in many ways, especially in buying a great deal of its locomotive sand and track ballast from the company. Of course this is good business as the company is a good customer and anything which contributes to its prosperity is reflected in the earnings of the railroad.

## Peru Establishes a Road Holiday

By executive decree Peru has established a road day, "El dia del Camino." This will be celebrated October 5, of every year, in accordance with a decision of the First Pan American Congress held at Buenos Aires in October, 1925. The decree sets forth the purpose of the Peruvian Government to continue energetically its road building program. Besides official ceremonies of various kinds, the celebration of the holiday will include: 1. Exemption of payment of road tolls throughout all the Peruvian territory. 2. Inauguration of new roads constructed during the year. 3. Conferences at the engineering institutions and theaters relative to the subject.

## Pit and Quarry Helps Industry

C. E. Torkelson, writes "Pit and Quarry is getting better every issue and is sure a help to the industry."

# IMPROVEMENTS IN ELECTRIC MOTORS

ELECTRIC motors have reached such a high degree of refinement and their general dependability is so unquestioned that the average user of motors is often apt to overlook the constant development which is going on in this equipment. There have been many improvements made in electric motors during the past few years. Such developments have been concerned mainly with the problems of adapting motors for specific applications and to reduce the necessity for frequent inspection.

Although the standard open frame squirrel cage motor meets most of the requirements for ordinary service, it has certain disadvantages which become rather serious in many applications. It has been found, for instance, that a standard open frame motor operated in places where there is considerable dust in the air will soon have its air passages clogged resulting eventually in overheating unless the motor is frequently cleaned. An even more serious condition exists in cases where the air is full of metallic dust, particularly iron dust, because such metallic dust works into the winding and may in time cause a break down of the insulation.

There has been a constant demand for an enclosed type of motor to meet these particular operating conditions and there have been a number of developments in enclosed motors in the attempt to solve this problem. The totally enclosed motor has been used in such service but as such a motor has no means of ventilation it must be made considerably larger than a standard motor of the same horsepower output. The result is high first cost per horsepower, poor power factor and poor efficiency. The sizes in which the totally enclosed motor may be built are therefore considerably limited and the cost per horsepower is always considerably higher than a standard motor.

Another development in enclosed motors has been the use of air piping for conducting clean air to the motor with a fan built into the rotor of the motor for providing the necessary flow of air. The disadvantage of this type of motor is due mainly to the necessity for providing the air pipes. This not only adds to the expense of the installation but frequently it is difficult to reach a source of clean air within practical distances from the motor so that elaborate systems of air ducts are required.

The answer to the enclosed motor problem appears to lie in the recent development of enclosed self-ventilated types in which the windings are entirely protected from the air currents. There have been several developments along this line, one of the most interesting of which is the recent announcement by Fairbanks, Morse & Company of a line of self ventilated enclosed motors which also have an interesting air cleaner feature. The

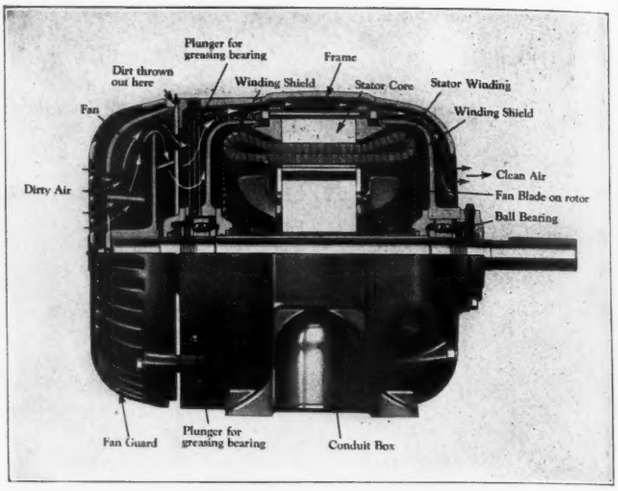



Fig. 1

accompanying sectional view of one of these motors shows the construction very clearly.

This motor has a standard stator core and windings and a standard rotor mounted in a supporting shell with an annular air passage between the outside surface of the stator core and the shell. Winding shields are provided so that the stator windings are totally enclosed, thereby preventing any dirt from gaining access to these windings. Cooling air is drawn through an inlet opening at the free end of the motor by means of a special type fan which also functions as an air cleaner. The clean air is blown across the winding shield at the free end of the motor, through the annular air space, then across the outer end of the stator core laminations, thence across the winding shield at the pulley end and out through openings in the pulley end bearing arm.

The fan is of the closed impeller type and is so constructed that the foreign particles are thrown out by centrifugal force, between the edge of the outer shroud and the supporting frame. A perforated guard is placed around this fan-cleaner and is carried by the supporting frame. The whole purpose of this guard is to prevent accidental contact with the fan; the fan itself being an entirely self contained air cleaner and blower.

Provision is made for lubricating the ball bearings of this motor without removing the guard, fan or bearing arms. This is accomplished by the use of a plunger device located in a grease tube extending through an opening in the bearing arm into the bearing housing.

The important advantages of this type of motor are: 1. It is completely self ventilated and cleans its own cooling air by means of a built-in automatic air cleaner. 2. That it is impervious to dust and dirt in the air. 3. It is built in the same frame diameter as standard motors of corresponding

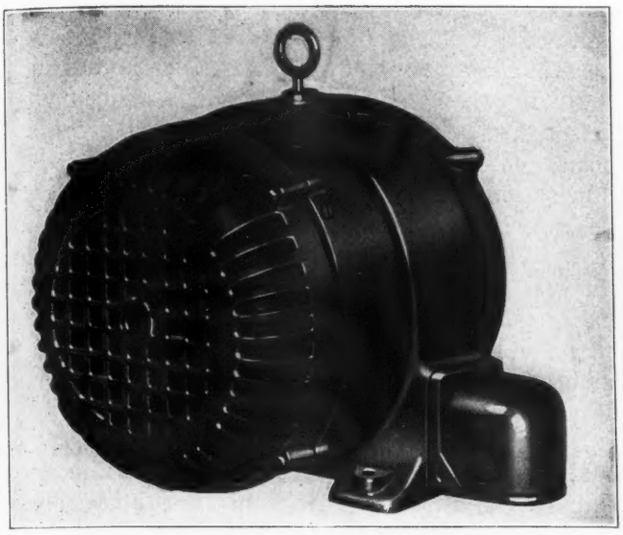


Fig. 2

horsepower. 4. No air piping of any kind required. 5. Will operate in the dustiest locations without requiring any blowing out. 6. Reduces fire hazard as the windings are totally enclosed and the air for ventilation does not come in contact with them. 7. It requires no more attention than a standard ball bearing motor.

There are many fields of service such as flour mills, saw mills, rock quarries, machine shops, chemical plants, cement mills, ice plants and similar service where motors must be protected from dust, sawdust, metallic particles or corrosive liquids and fumes. The demand for a simple enclosed self ventilated type of motor which will give this protection has been considerable and the recent developments in motors of this type will solve one of the difficult motor application problems.

The simplicity of the squirrel cage motor has resulted in a widespread adoption of this type of motor in all applications where speed variation is not required and where alternating current is available. The one main disadvantage of the squirrel cage motor has been due to the high starting current. In small motors the higher starting current is not objectionable for most power companies will permit the installation of motors up to 5 horsepower without requiring the use of some type of starting compensator. With larger motors, however, it is necessary to use some type of starter which will reduce the voltage and thus limit the current during the starting period. On types of service requiring a high starting torque such as those having considerable inertia or static friction, the starting currents are still greater and if starters of the reduced voltage type are used the starting torque of the motor is considerably reduced.

In the design of squirrel cage motors it is possible to use high resistance rotor bars in order to get a high starting torque with low starting current but such a motor has comparatively low efficiency and poor power factor at full load and normal speed. If the motor is designed with low resistance bars in the rotor, then the starting torque is reduced and the starting current is increased although the motor has better operating characteristics at normal loads and speed.

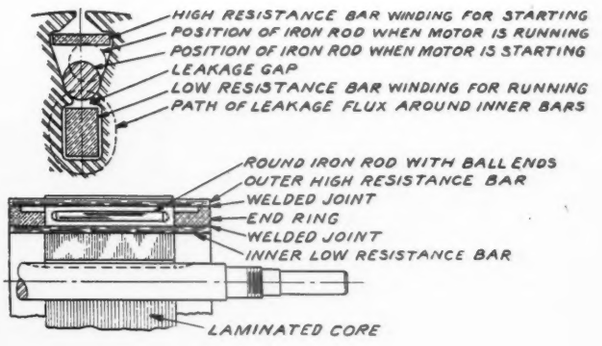

HIGH RESISTANCE BAR WINDING FOR STARTING
POSITION OF IRON ROD WHEN MOTOR IS RUNNING
POSITION OF IRON ROD WHEN MOTOR IS STARTING
LEAKAGE GAP
LOW RESISTANCE BAR WINDING FOR RUNNING
PATH OF LEAKAGE FLUX AROUND INNER BARS
ROUND IRON ROD WITH BALL ENDS
OUTER HIGH RESISTANCE BAR
WELDED JOINT
END RING
WELDED JOINT
INNER LOW RESISTANCE BAR
LAMINATED CORE

Fig. 3

During the past few years one of the motor developments has been what is known as the double squirrel cage type. In this motor two sets of bars are placed in the rotor, each set being connected with its own end rings. The low resistance bars in this case are placed in comparatively deep slots in the rotor and the higher resistance bars in comparatively shallow slots. The inner low resistance winding in the iron rotor core chokes the current in this winding at starting and forces it to flow in the outer high resistance winding thereby producing high starting torque with comparatively low starting current. After the motor has accelerated and is carrying normal load, the low resistance winding carries the greater portion of the current but due to its position in the rotor core the power factor and maximum torque are less than with a standard or single squirrel cage winding.

The advantages of the double squirrel cage motor are as follows:

1. Can be connected directly to the line without using a compensator or starter to reduce the starting current.

2. Has ample torque to start and accelerate loads having considerable inertia or static friction.

3. Simplifies the control of the motor by using an ordinary starting switch or by using a magnetic contactor with push button control.

The principal disadvantage of the double squirrel cage motor are its low maximum output and poor running performance as compared with the single squirrel cage motor. The low maximum output is objectionable because momentary overloading together with reduced line voltage may result in the motor stopping. The running performance is affected principally by low power factor and efficiency. The low efficiency increases the power cost of operating the motor and the low power factor is objectionable to the power company.

The most recent development in a double squirrel cage motor is that of Fairbanks, Morse and Com-

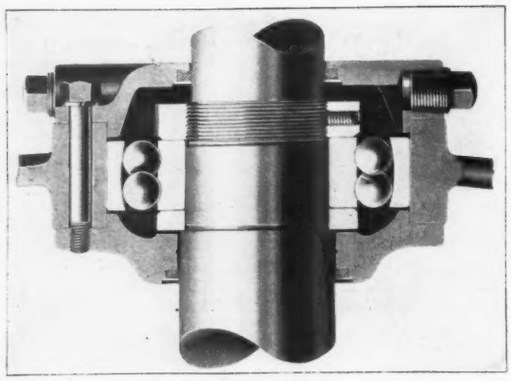


Fig. 4

pany in a motor which is called a variable leakage double squirrel cage type. The accompanying illustration shows a section through the rotor slots which gives an idea of the construction of this motor. In this motor the current in the inner winding at starting is choked by means of movable iron rods. These rods are placed in each rotor slot between the inner and outer bars. The instant the motor is connected to the line the iron rods are pulled down towards the inner bars closing the small leakage gap in the rotor iron which almost completely chokes the current in the inner low resistance winding by forming a complete iron circuit around each inner bar. This choking action on the inner winding forces practically all of the current to flow in the outer high resistance winding at starting thus producing a high starting torque with a low starting current.

As the rotor accelerates the iron rods are thrown out of the leakage gaps by centrifugal force which removes the choking effects from the inner winding when the motor is running. This results in a much better running performance than is possible with the older style of double squirrel cage motor. It is also possible to use much higher resistance in the outer winding where exceptionally low starting current is desired and where the starting torque requirements are moderate. At starting there is a slight noise due to the rods changing position but since this change is practically instantaneous the noise is not objectionable.

Another important refinement in the construction of electric motors has been in connection with bearings. The use of ball bearings has made phenomenal progress because this type of bearing has shown many very practical advantages as compared with the use of sleeve bearings.

Statistics have shown that more than 40 per cent of motor repairs are made necessary by the break down of windings which have become oil soaked. With sleeve bearings it has been found almost impossible to seal the bearing tightly enough to keep the oil from traveling along the shaft and thus getting into the winding. The difficulty is still further increased when the motors are required to operate under high temperature conditions as the oil thins out and will work out of the bearings in spite of felt washers or any other method which is used in the attempt to keep the oil in the bearings.

An important advantage of ball bearing motors arises from the manner in which they are lubricated. Grease is used rather than oil. Grease lubrication in combination with tightly-sealed bearing housings makes the motor free from oil leakage, dripping or spattering. Grease lubrication likewise prevents oil from spattering outside of the motor. Ball bearing motors are usually provided with sufficient grease in the bearing housing to lubricate the bearings for a year of ordinary service.

Ball bearings are not affected by ordinary belt or chain tension or gear pressure. There is no appreciable wear on ball bearings and the highest possible mechanical efficiency is obtained. The possibility of wear from grit or dust is entirely eliminated because the use of ball bearings permits the use of a bearing housing which positively excludes all foreign material.

The absence of wear on ball bearings keeps the rotor shaft in alignment, maintains the uniformily small air gap necessary for high efficiency, and prevents the rotor from rubbing against the stator and eventually causing a burnout. Bearing replacements on ball bearing motors are almost unknown. Even under the severest operating conditions they have run for years with practically no attention. Replacement is easily accomplished if necessary.

The anti-friction aspect of ball bearings assumes increased importance as the use of electric motors becomes greater. Accurate tests and carefully conducted observations of motors in actual service have conclusively demonstrated that ball bearings actually reduce friction enough to save considerable power. In almost every case enough can be saved in one year by the use of ball bearings to more than pay for the additional cost of motors equipped with them, even where power is comparatively cheap. Thereafter, throughout the life of the motor, the ball bearings will pay steady dividends in reduced power bills.

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## Maryland Opens Important Highway

The Robert Crain Highway, formally opened on October 22, connects Baltimore for the first time with the southern part of the state. Towns and cities in the comparatively undeveloped southern section now have easy access to the metropolis over a modern, permanent roadway. Extending for a distance of over 75 miles, this concrete highway was placed through a portion of the country that had never before been brought into contact with the rest of Maryland. Robert Crain, the man for whom the road was named, visioned the idea of such a highway and donated a substantial sum for its building.

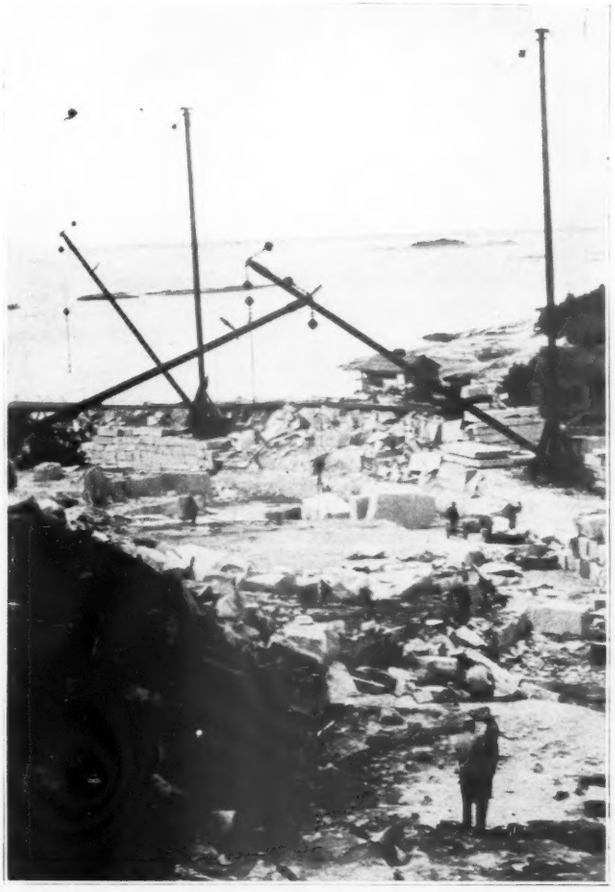
# COMPLETELY MODERN GRANITE OPERATION FOUND OFF THE COAST OF MAINE

By F. A. Westbrook

THE Deer Island Granite Corporation with quarries on Croch Island, Maine, has been in business about four years. It purchased the interests of the Benvenue Granite Corporation and is controlled by the three McGuire brothers. Mr. Thomas McGuire is president of the company. James McGuire is the treasurer and looks after the selling end of the business. Both are located in New York. Frank McGuire is general manager and superintendent at the quarries. Formerly he was superintendent of the famous Settlement Quarry on Deer Island, now closed down.

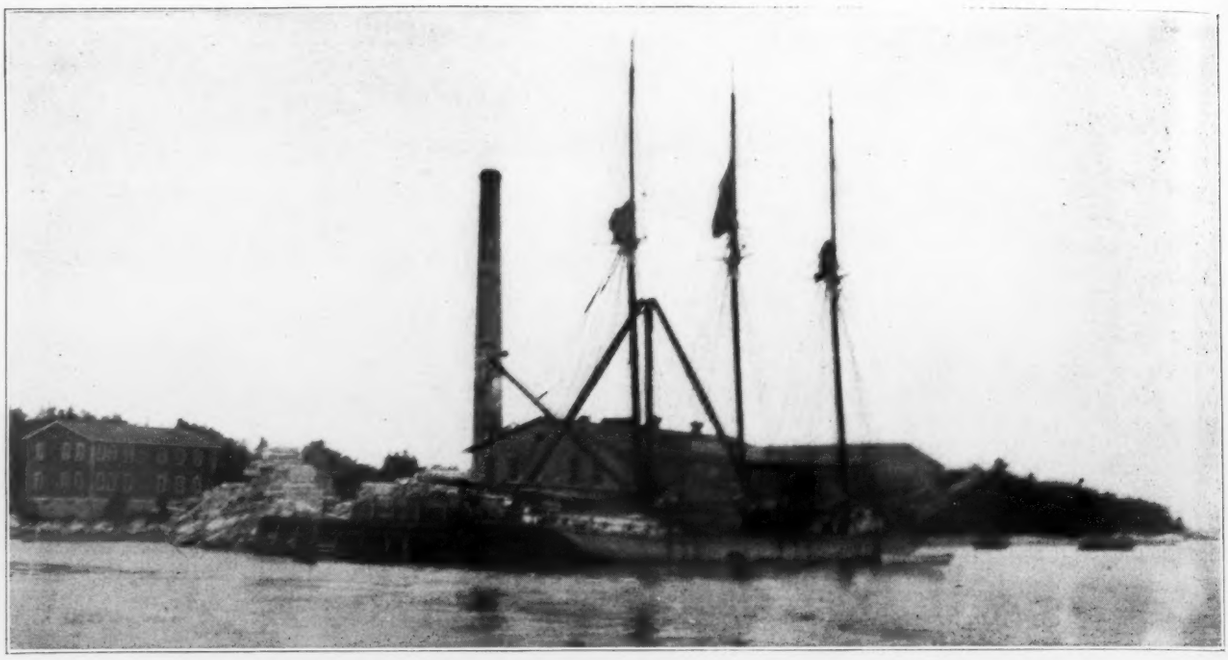
The work which is carried on here is on a big scale on big jobs. In the first place about 1,000 tons of rough stock are shipped to New York every month for general contract work. In addition to this it is supplying some of the stone for the new cathedral of St. John the Divine in New York, for the reconstruction of the old High Bridge across the Harlem River, for the new Pennsylvania R.R. bridge across Newark Bay and for the large new breakwater at Saco, Maine. Strippings are largely used for the latter. This company also has several other equally large and important jobs to its credit such as the Farnham Mausoleum in Newark, N. J., and the Roosevelt Avenue Bridge in New York.

The great thing about these island quarries along the coast of Maine is that shipments can be made by water from the quarry company's dock (in

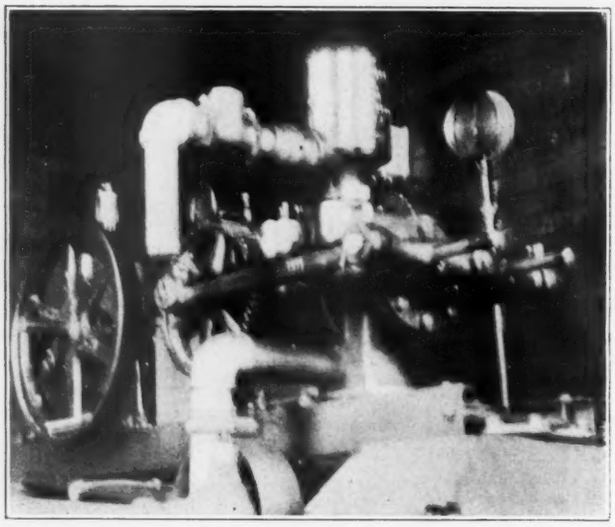


Portion of the Quarry from the Top Showing Other Islands in the Background

Quarry from Below. One of the Flat Cars in the Foreground.



A Schooner Tied to the Company's Dock. Power House at Right and Office Building to Left



Gasoline Engine Driven Pump

the case of the bridge material) direct to the job without handling. The Bee Line Transportation Company does most of this work. There are indeed few industries of any kind where the question of transportation is so easily and economically solved. Croch Island is separated from the town of Stonington on Deer Island by a waterway perhaps half a mile wide. Stonington is where all the granite workers live and it is a most attractive and picturesque village. Fishing also plays an important part in the life of the place and has been for many years the principal industry. Some of the illustrations show how wharves and buildings along the shore have been built of granite blocks, now blackened by marine growths and the action of the tides, immovable against the heavy winter ice floes.

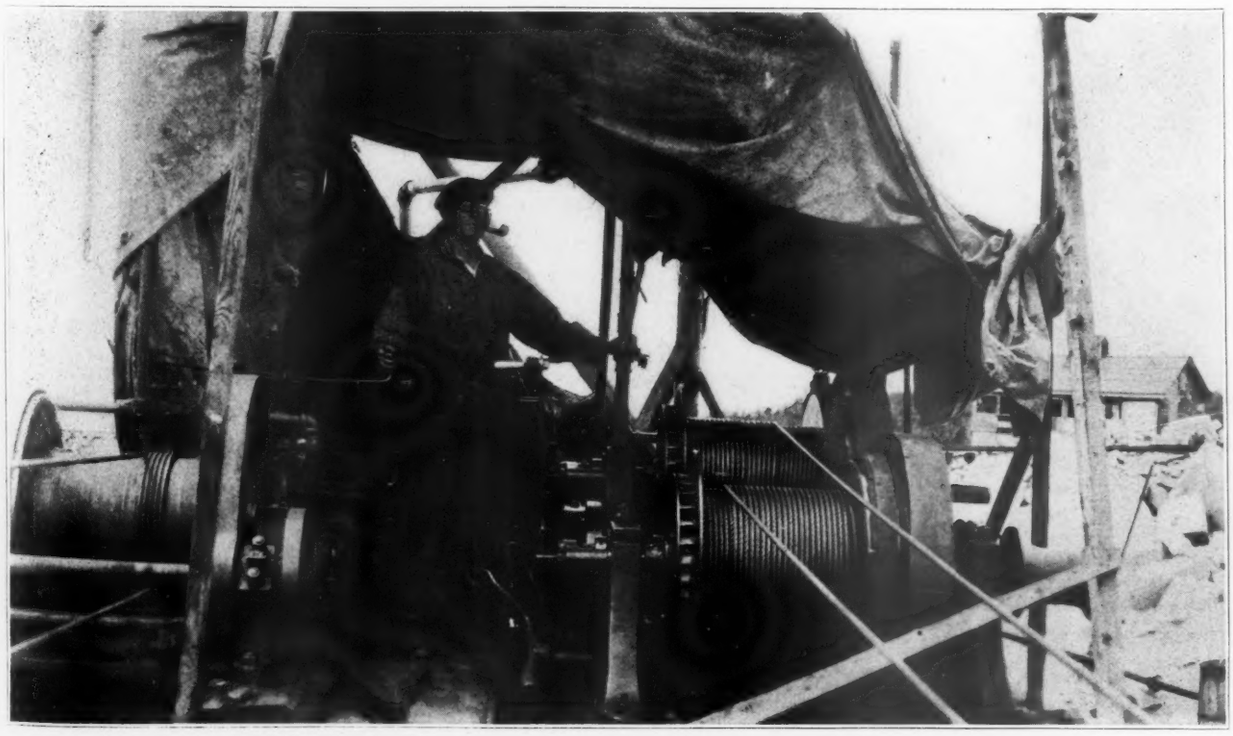
Of course it is necessary to transport the help across the channel and for this purpose the com-

Picturesque Waterfront of Stonington, Across the Channel from Croch Island. Note the Part Played by Rough Granite Blocks.

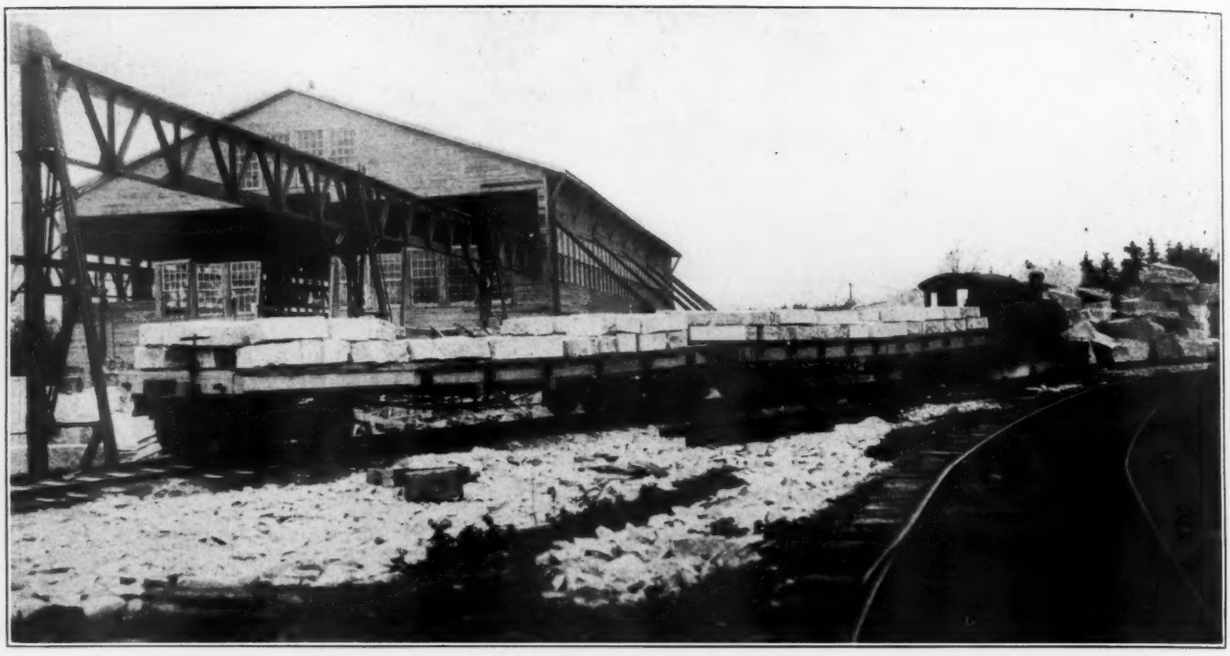
View of Stonington from the Steamboat Landing

pany has a very fine power boat, the "Sunbeam"—really a small cruising yacht. It can carry as many as two hundred. This yacht is also one of the places where Mr. Frank McGuire demonstrates what real hospitality is. At the time of my visit Mr. W. Pagano, large New York stone contractor, was there with his family and we were treated to a shore dinner in the cabin of the "Sunbeam" which would put to shame the best efforts of the much advertised shore resorts. We had noticed a lobster boat with its morning's catch alongside the "Sunbeam" and judging from the bounteousness of the repast it must have parted with practically its whole cargo right there. That really fresh clams and lobsters are easily digestible is shown by the fact that probably for the first time in the lives of all of the visitors, certainly in mine, we ate our fill of this delicious food and no one suffered the slightest ill effects.

There are times in the seasons of big storms in



Hoisting Engine Operated by Compressed Air Just Moved to Temporary Location



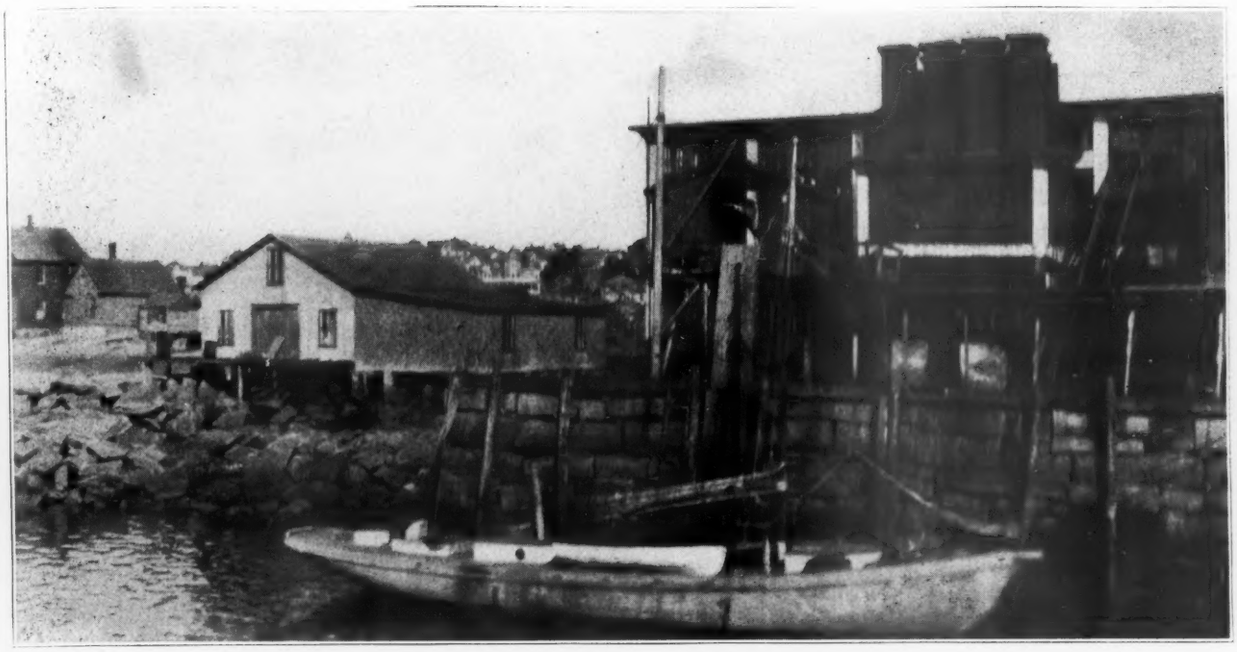
A Train of Granite Coming In

this northern Atlantic region when it is impossible to bring the men back and forth to Stonington. On such occasions the upper floor of the large office building is used as a dormitory. There are a quantity of iron cots and a well equipped kitchen here which, together with the steam heat make it a very comfortable place to stay. The neatness and cleanliness of all parts of the building, which also includes a repair shop, are noteworthy.

Of course to have housing facilities such as these places the company in a position not only to retain the best help but also to keep up production in whole or in part when it would otherwise be impossible—a matter of great importance from the standpoint of the producer as well as of the customer.

In this location it is necessary for the company to generate its own power. The power house is located near the wharf and is a fine building made of granite blocks. In it is located an Ingersoll Rand T-10 two stage, compound engine driven compressor unit of 2400 foot capacity. There is also a James Begg and Company single cylinder engine which drives a General Electric 240 volt, 300 ampere direct current generator which supplies power for the traveling crane in the cutting shed. A Gen-

Interior of Cutting Shed



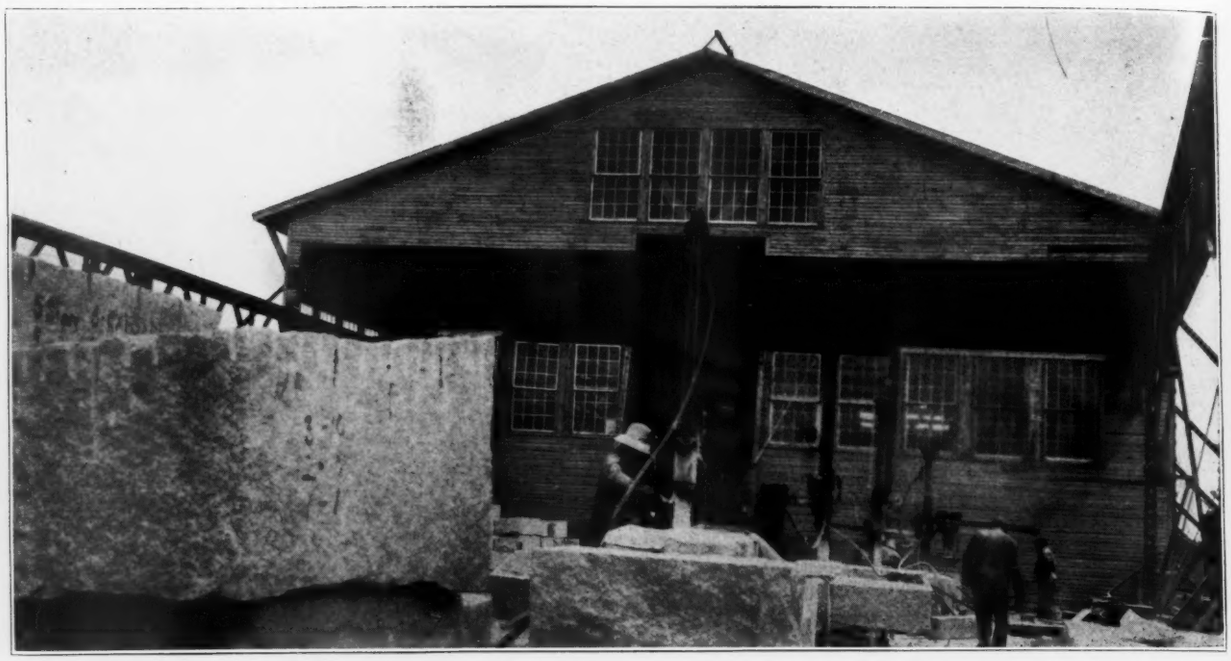
Fishing Boat Unloading at Stonington Wharf Made of Granite Blocks

eral Electric marine oil engine direct connected to a small direct current generator supplies current for lighting when the rest of the power plant is shut down and is especially useful in the early morning when the night man starts up the boilers. The latter were supplied by the Chicago House Wrecking Company.

Boiler feed water and circulating water for the compressor and for the quarries is obtained from fresh water ponds on the island. Two Cameron compressed air driven pumps and a Myers gasoline engine driven pump force the water to the power house, to the quarry and elsewhere. The pipes, of course, have been buried below the frost line and valve houses have been built at points where the flow is directed in various directions.

Power transmission to the various points of this operation means piping compressed air. It is used, of course, in the cutting shed for the pneumatic tools and in the quarry for drilling in the usual manner. It is also used to run two water pumps, as already noted, and the hoisting engines in the quarry. To do this has meant the installation of a mile and a half of pipe. Air receivers have been installed at three different points to dry the air so that it can be used all winter, and Crane gate valves have been installed at various points for control purposes. At the quarry the 6 inch air line

One of the Locomotive Cranes and Traveling Crane



End of Cutting Shed Showing Craneway and Surfacing Machines

divides into three 4 inch branches—one on each side of the quarry and one through the center.

In view of the fact that so much dependence is placed on compressed air two precautions have been taken to provide against complete shutdown of operations in case of trouble with the main compressor unit at the power house. The first of these is an auxiliary air plant at the quarry consisting of one Ingersoll Rand and one Chicago Pneumatic compressor. Both are steam driven units and served by two Ross and Morrison boilers. The hoisting engines for the derricks are also provided with boilers so that they may also be run by steam if the air supply should fail.

Some views of the quarry with cars and derricks are shown. There are nine of the latter, each operated by Lidgerwood hoists in separate buildings. One of the illustrations shows a hoist just moved to a temporary position and without a boiler. Arthur McMullen Company derrick equipment is used and Roebling wire rope. In passing it is worth noting that the latter are kept well greased with W. A. Wood and Company's "Fall Grease," a very important detail for the preservation of the

Power House for Plant

Air Line Through Spruce Woods to Quarry. Railroad Track at Right

rope and for avoiding waste of power. Drilling in the quarry is done by Ingersoll Rand jack hammers and blasting with Du Pont powder and caps and a United States standard blasting machine. Channels are shot with Du Pont dynamite. There is a blacksmith shop at the quarry equipped with an Ingersoll Rand drill sharpening machine.

A standard gauge railroad track runs from the wharf past the cutting shed where there are numerous sidings and switches, some of which are under the overhead craneway, up to the quarry where there are more sidings and switches for the reading movements of blocks of stone. Part of this railway, between the cutting shed and the quarry, runs through the very beautiful spruce woods which cover all parts of the island not cleared for manufacturing purposes and which give such a distinct northern tone to the landscape. A 20 ton Vulcan locomotive hauls the cars back and forth over these tracks. Two Brown Hoist Company locomotive cranes, one 10 ton and the other 20 ton, also operate on them.

The cutting shed is a very well built structure with steel framework and wood sheathing. A 20 ton Shaw crane travels the length of this and out over a yard with seven Livingston surfacing machines. Inside the usual carving and cutting work is carried on with Livingston pneumatic tools. A new building is to be erected immediately alongside the outdoor craneway to house four Peck gang saws. A blacksmith shop is located near the cutting shed. In it are, among other things, a McDougall & Potter steam hammer and a Blount grinder.

In closing the description of this very complete and up-to-date plant it should be said that there are large deposits of the well known Croch Island pink granite which are still covered with spruce forest. There is enough to last for many years even at much higher rates of production than at present. In fact some jobs are now in sight which will call for much greater activity.

## Chile Shows Interest in Roads

The new government of Chile is showing active interest in improvement of highways. Throughout the country a great number of the roads are impassible at certain times of the year, and it has been pointed out in connection with the development of the country and the stimulation of home industries that this important question must be one of the first to be taken into consideration. Although the roads in the Province of Santiago are the best in the country, many of them are greatly in need of repair, and the Government has been asked to appropriate 27,000,000 Chilean pesos for the reconstruction of the most important roads leading into the capital. The actual distance of roads to be repaired is given at approximately 250 kilometers. Naturally this is only a drop in the bucket in comparison with what is needed, but with the Government's limited funds available it is a first step in the right direction. As time goes on, the work will undoubtedly be carried on more extensively.

# PURCHASING RECORDS AND SYSTEM

By J. J. Berliner

PURCHASING records are a very important factor in efficient buying. Before the purchasing agent can do his work efficiently, he must have before him certain information. All this data and information must be collected and classified in systematic form. Scientific purchasing lies in the breadth and strength of the purchasing executives judgment. In order to exercise this judgment ,he must be relieved of the minor details of department routine. A great many purchasing executives are so hampered by myriad little things that they have neither the time nor the energy to devote to their real work. For this reason, a well-defined purchasing system should be installed which will reduce clerical routine to its lowest denomination and free the purchasing agent from the obstruction of misplaced details.

The ideal purchasing system records every essential fact, with a minimum of labor, and in such shape that it is instantly available as a basis for intelligent decision and action. It encompasses continuity of facts which lead from the requisition to the paying of the invoice with information available at all times to show at just what stage the transaction has arrived. It should eliminate guess work and make the knowledge and experience of the department a matter of record rather than of recollection. It should insure accuracy on prices, quantities and deliveries, and automatically prevent duplication of orders and twice paid invoices.

However, no system can attain such perfection that it will run itself. Any method of recording purchasing activities should be self-checking throughout; should eliminate as much possibility of error through transcription as may be obtained; and should require as little supervision as is consistent with the importance of the information recorded.

The Requisition.—For reference and certainty, all purchases should be based upon written requisitions. Usually these originate in the stock department, although some concerns allow foremen to issue requisitions for their particular departments. A majority of concerns have a central stock clerk, who alone is responsible for all of the stock and raw material used in the plant. In such instances, the various department foremen look to him both for stock and information, and he, in turn is representative of them, and stands between them and the purchasing agent in the daily affairs. The requisition blank should be of standard size and should contain the following:

1. Size 4 and 6, or 5 by 8, or 8 by 10, for convenience in filing.

2. Numbered in sequence for the convenience of the stock clerk in the following up for convenience of the purchasing agent in filing.

3. Show quantity and quality desired, with sufficient detail to allow the purchasing agent to answer any questions put to him by the vender, in case of doubt. (This latter applies more particularly to tools, machine fittings, hardware, electric appliances, etc.; which require special articles for special work.)

4. Show the nature of the work intended to be done with the articles ordered except in case of raw material.

5. The department for which the goods are intended should appear to enable the purchasing agent readily to obtain first-hand information if necessary.

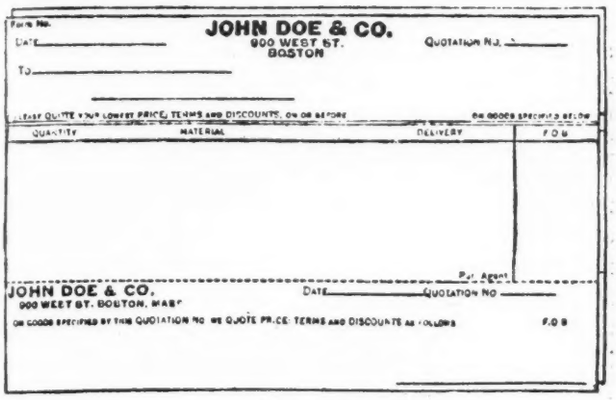
6. Provide suitable space for typing in the purchase order number for convenience in reference.

7. At least two copies should be made out; more if the system involved in a particular case necessitates it. If the stock clerk is provided with a copy of the purchase order (see the purchase order), two copies of the requisition are sufficient; but if the stock clerk does not receive a copy of the purchase order, two copies of the requisition are sufficient; but if the stock clerk does not receive a copy of the purchase order, which is to inform him of the daily purchases, then a third copy of the requisition is advisable. The third copy of the requisition is to go to the purchasing agent with his original copy, and he is to state on it that goods have been ordered, and return the same to the stock clerk.

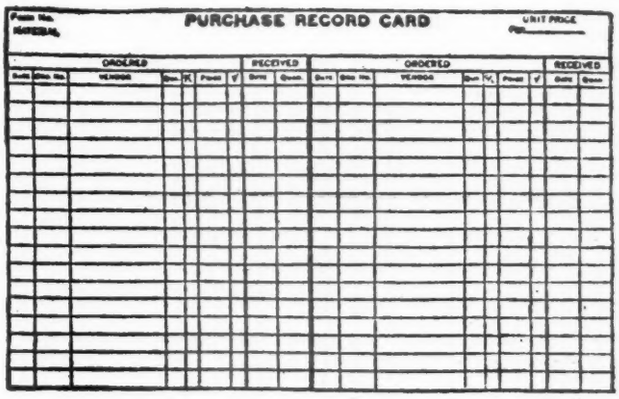
If a requisition blank is provided with the above information it covers all points necessary to begin a purchase, and is suitably provided with the essential features to permit following up by the stock clerk, and reference by the purchasing agent.

Filing and Requisition.—The purchasing agent, after he has written the order and has typed in the order number on the quotation (see quotation blank), should file his copy under commodities and on following-up can refer to the requisition by number, thus enabling the purchasing agent to have ready and quick reference to it. On looking up the order, the purchase order number and the whole transaction will be immediately connected. This involves two references to the purchasing agent's files, but is presumably the least number of times necessary, in order to be sure of accuracy, for, by reference to requisition number, the purchase number of the article wanted is brought to attention, and an error cannot take place.

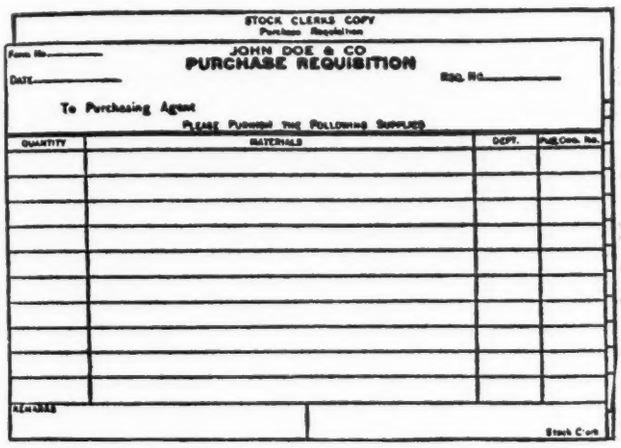
Quotations.—Whenever and wherever time and conditions permit, and it is deemed advisable, quo-


JOHN DOE & CO.
900 WEST ST.
BOSTON

—QUOTATION BLANK.


PURCHASE RECORD CARD

-PURCHASE RECORD CARD.


STOCK CLERKS COPY
Purchase Requisition
JOHN DOE & CO
PURCHASE REQUISITION

—THE REQUISITION BLANK.

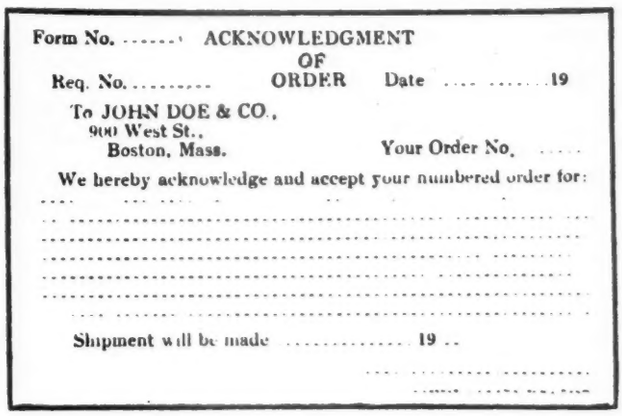
tations should be obtained from several dealers. Many concerns prefer doing this by letter, but the simplest and best method would be by regular printed quotation from blank with necessary details of such a transaction, showing the requisition number, and with suitable space for specifications. The time limit for an answer should be printed thereon, and, by having a printed form typed in, as necessary, dealers immediately sense the fact that other firms are receiving this quotation, and it has a tendency to bring results in the form of the lowest possible price.

The Purchase Order.—In making out purchase orders, care should be taken by purchasing agents and their clerks to specify sufficient detail to make a complete statement of what is ordered as to quantity and quality, prices, discounts, terms, routing, etc., which, if followed carefully, will prove valuable in case of disputes or litigations. In all such cases the order is the foundation of the firm's claim and must be depended upon to prove any contention that may arise. A contract is formed upon the vender's acceptance of the purchaser's offer to buy and, if goods are not up to quality, and the order has been concise, clear, and definite, the purchasing agent's firm will be protected.

The purchase order should contain the following:

1. The size should be standard. A margin of ¾ inch is allowed at the left side, for punching for post binders.

ACKNOWLEDGMENT FORM


Form No. ..... ACKNOWLEDGMENT
OF
Req. No. ..... ORDER Date .... .....19
To JOHN DOE & CO.,
900 West St.,
Boston, Mass. Your Order No. .....
We hereby acknowledge and accept your numbered order for:
Shipment will be made ..... 19 ..

2. The data appearing on the purchase order should contain:

(1) Order number in sequence, with request on vender's copy and the copy retained by the purchasing agent, that the purchase order number appear on all packages, cases, and invoices.

(2) Date of order.

(3) Requisition number, department, stores or division number and seller's number.

(4) Name and address of the vending company.

(5) Shipping address, routing and date to be shipped.

(6) Address to which invoices and original bill of lading are to be mailed, with request for duplicate or triplicate if desired.

(7) The order should be typed in clearly and definitely with price, discount, and terms, whenever possible, and whether F. O. B. destination or not.

There should be at least four copies of the purchase order as follows:

(a) One copy for the vender.

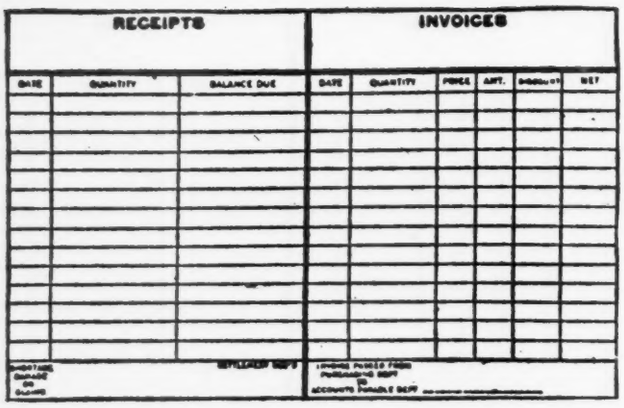
(b) One copy for the receiving clerk.

(c) One copy for the stock clerk.

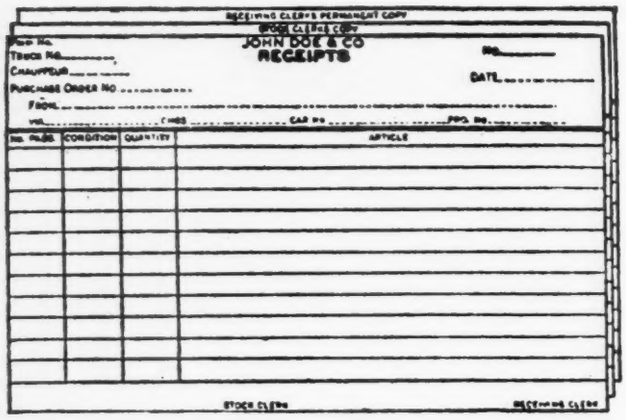
(d) One copy to be retained by the purchasing department for its permanent records.

Sometimes a fifth copy is made for later reference to the accounting department.

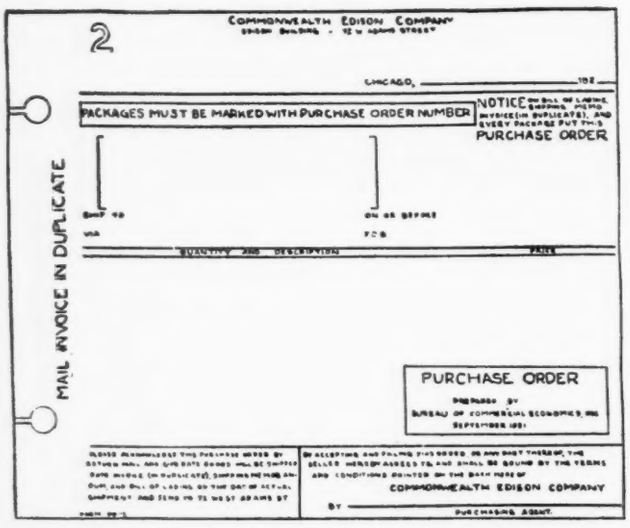
Acknowledgment.—It is advisable for all purchasing agents to make suitable arrangements to




FORM APPEARING ON REVERSE SIDE OF PURCHASE ORDER




RECEIVING RECORD.




obtain acknowledgment on orders, particularly on those which come from other than local territory. The form of acknowledgment is generally one of three methods:

(1) Some companies send an extra copy of the purchase order to the vender, suitably printed for an acknowledgment.

(2) A second method is to have an attached perforated slip at the bottom of the vender's copy of the order, which gives the order, number and date, and leaves a space for the vender to fill, on which he will specify the date of shipment.

(3) The third method consists of a separate acknowledgment form (which see) which includes printed data of requisition number, date, order number, name and address of the purchasing company, space for the listing of the items ordered and the date upon which the vender will make shipment. Some concerns do not require the acknowledgment to list the items, considering the order number and the date of shipment to be sufficient for record purposes. This form is often printed upon a postal card bearing the printed address of the purchasing company with the request to return the same.

After the order is submitted and acknowledgment is received, or if the information as to time of shipment is received in any other way, the order is within the sphere of the Follow-up Department which may be conducted by the purchasing agent himself, or, as many concerns are doing, by means of a clerk who has sole charge of this.

The Rollow-up System.—It is necessary, in order to get satisfactory service, and to keep the purchasing firm advised regarding deliveries, to adopt a follow-up system.

A great many concerns use a signal system, which is a small, metal, movable tab, placed on top of the purchasing agent's copy of the order. This top is marked off numerically from 1 to 31, inclusive, or any other number. The tab is placed over the number corresponding to the one on which advice has been received that shipment will be made. In connection with this point of determining the date of shipment, it is easy to see that the acknowledgment of the order occupies a place of the utmost importance. The signal tabs arrange themselves in a straight line throughout the order file, and all tabs for given dates can instantly be noted and the cards removed. The first thing to do is to ascertain whether the invoice from the shipper has been received. If not, a letter or blank form of inquiry should be sent out and the tab moved ahead the requisite number of days for the receipt of the answer. The table should then be changed to conform to the answer.

Many concerns, however, prefer to use an extra copy of the purchase order, with the proper notations made thereon by the purchasing agent or clerk in charge as to the probable date of shipment. This copy is filed by date of expected shipment and on each day letters of blank inquiry forms are sent to those venders from whom no invoices have been received as expected.

Either system will bring results if properly looked after, and special care should be taken of the follow-up records whatever the method used. A great deal of money and time can be lost by a concern whose shipments are not received promptly.

Record Cards.—A record card of some form is necessary to every purchasing department. In considering this card, it is necessary to decide what

information, and how much, the purchasing agent needs for ready reference in the future concerning the article purchased, the quantity, the price, and from whom purchased. These cards should be indexed under the name of commodities.

Experience has shown that the following items are necessary upon the record card (see form).

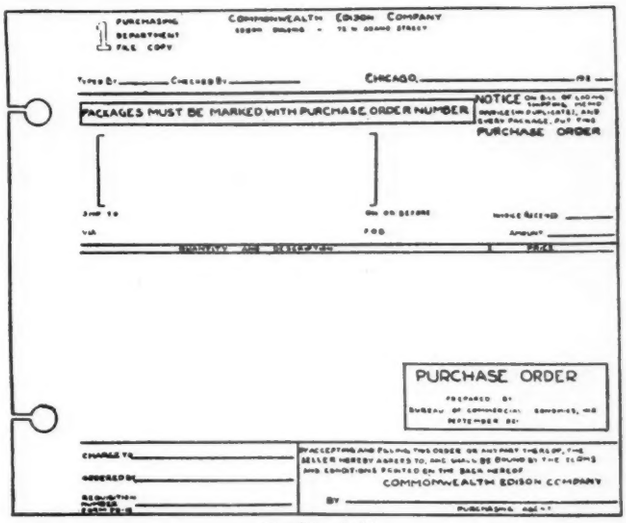
1. Order number and date.
2. Name of vender.
3. Unit price.
4. Date of shipment.
5. Quantity, price and discount, or net price per unit.
6. Column for checking price if O. K.
7. Date of delivery.

Filing the Record Card.—The record card in general use is of standard size of 5 by 8 inches or 8 by 10.

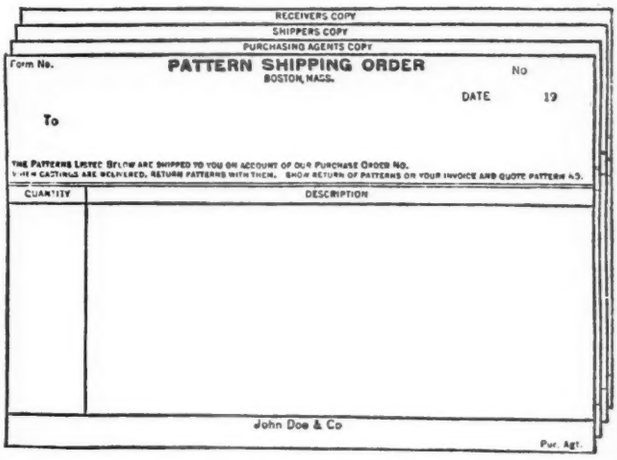
The record card should be filed by commodities, in a file classified by departments, or by expenses, such as raw materials, general expense, power and heat, etc.

Receiving Records.—The functions of the receiving department are closely allied to the purchasing department, and the two should work in conjunction. As stated before, the receiving clerk is provided with a copy of the purchase order for his guidance in determining the name of the shipper and the quantity of goods expected to be received. However, some concerns omit from this copy of the purchase order the quantity of goods expected to be purchased. The explanation of this omission is that the receiver will make a more accurate count and will not be tempted to copy the quantity purchased without honestly counting the same. The majority of firms, however, place sufficient confidence in their receiver to trust him not to neglect a proper checking of deliveries, and they feel that by showing the quantity ordered, he will be more apt to detect shortages than otherwise.

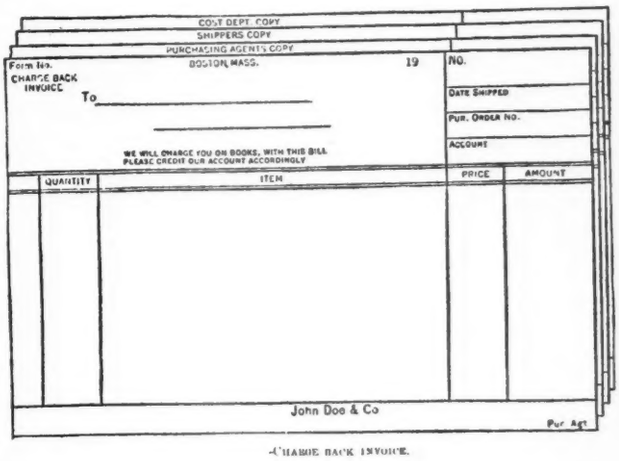
This copy of the purchase order is given to the receiver as a guide, and it is not customary for him to make his return thereon. For this purpose (see form), printed "Receiving Record," are provided in triplicate. It shows the name of the shipper, the name of the transportation company, pro number, order number, and freight charges at the top and the quantity and name of goods below. Slips are, of course, entered by the receiving clerk. The original and duplicate are forwarded to the stock clerk or to the department heads, according to the method employed in the different companies. The original is signed by the person who receives it and passed on to the purchasing department. The duplicate is either retained by the stock clerk or department head, and the perpetual inventory is posted from it—if he keeps it—and, if not, the duplicate is sent to the department which does keep the perpetual inventory.




Size 7" x 8½"




-Pattern shipping order




-Charge back invoice.

Checking Invoices.—The purchasing agent, if possible, should check all invoices for the material which he has ordered, as he is in a position to know the quality and quantity wanted, and is familiar with the samples, the needs of the concern, etc. To allow any other department to check invoices is not for the best interests of the concern, although some companies employ it as a safeguard, Having received the original and the receiving record, the purchasing agent compares them with the

invoice, makes notations of any shortage, attaches the receiving slips to the back of the invoice and passes it to the clerk who enters the record cards.

A very good system adapted by some concerns is as follows:

On the back of the purchasing agent's office copy of the order there is kept (see form), one-half of the sheet, a record of all receipts pertaining to that order, and other data necessary, and, on the other half, a record of invoices as to date, quantity, price, discounts, and when possiple, the invoice number. When the shipment is completed and invoice are paid the purchasing agent's copy will bear a complete record of the transaction; on one side, the order itself, and on the reverse side full information concerning the receipts, etc. Such a record is valuable for reference purposes and requires no more time or labor than the various other methods.

Shortage.—Any shortages of overcharges noted are referred to the Traffic or Claim Department. In some cases such notations are referred back to the purchasing agent himself, who makes claim upon the shipper or transportation company according to the liability for any damage, loss or shortage. If referred to the Claim Department, the purchasing agent should employ a blank form made out in duplicate, one copy going to the Claim Department and the other to the Accounts Payable Department attached to the invoice before it is approved by the Purchasing Department. When the claim is adjusted and credit or check received, the fact should be noted on the blank and forwarded to the Accounts Payable Department. In case the purchasing agent makes the claim himself, he retains the copy of the blank that would have gone to the Claim Department makes the proper notations upon it, and sends it to the Accounting department.

Goods Returned for Credit.—In case of goods returned for any reason, a standard form (see form) which should be used. It consists of any original and three copies. The original is mailed to the vender to whom the goods are returned. One copy is kept by the purchasing agent; one is sent to the shipping room; and one is forwarded to the Accounting Department for proper entry on the books.

## A Swedish National Highway Board

A National Highway Boards Association was established recently in Sweden at a meeting of officials from about forty of the provincial highway boards, held in Stockholm. About sixty-five highway districts already have joined this association, and it is believed that soon all local boards will become members. The purpose of this association is to promote good roads activities, to assist the various provincial highway boards in the solution of their problems and to function as a special advisor on highway construction to all members.

## Fire Should Be a Disgrace

The undisputed fact that America is rich is no excuse for throwing away more than half a billion dollars per year in fire losses. We shudder to think that once the custom of burning people at the stake was considered respectable; but in the very modern year of 1926, 10,000 people in the United States alone lost their lives by fire, and that figure represents a reduction of about 34 per cent from three years before. This reduction was due chiefly to extensive educational work carried on in the interest of fire prevention.

The average fire loss last year in 377 American cities was $3.35 per capita. Each and every property owner pays that loss in insurance rates. We did not avoid our share of it, even though we had no fire on our own property. Insurance is surely a method of distributing the loss. A foreign invasion would hardly destroy more property than our annual fire scourge.

The greater part of this loss of life and property is avoidable. The average fire loss for British cities was about $1. For continental Europe there are no recent figures at hand, but in 1913 the average per capita fire loss for France was 49c, for Germany 28c, for Italy and Austria 25c, for Switzerland 15c and for Holland only 11c. Yet we have the best equipped fire department in the world. The only country we know of where a fire loss is greater than ours in proportion either to wealth or population is China, where the equipment of the fire departments is unbelievably inadequate.

The fire loss is not, like the weather, something that we must passively endure. We can do something to reduce this loss and save human lives. Carelessness is the chief cause of fires. We can train ourselves, our families, and our employees to be careful with fire—with matches, cigarette butts, oily waste, stoves, ashes, and open lights. Then it is our duty, law or no law, to provide proper fire escapes, extinguishers, or sprinklers. The first three minutes is the critical time in every fire. Educational efforts in fire prevention are not wasted. There is evidence of improvement. For the first six months of the current year, fire losses have run 20 per cent under the corresponding figure of 1926. Help to keep the losses down. To have a fire is not only a misfortune; it is a disgrace!

## Artificial Marble

A solution of zinc and magnesium sulphates is treated in a colloid mill with vaseline oil and phenol-formaldehyde condensation products. The viscous colloidal product is made slightly acid with sulphuric acid and added to a mixture of magnesia with water and a suitable filler, such as barium sulphate. Bia & Bielize (British Patent 275,448).

# PIT AND QUARRY FOREIGN DIGEST

## Plaster Compositions

Calcium sulphate of any origin is wet ground to obtain a viscous highly plastic mass which is self setting and hardening; the resulting product may be dried and ground to powder, and the operations may be repeated, if desired. By regulating the amount of water added at any stage of the process, a stiff paste moldable in a string press, a mortar or a coating paste may be obtained; and the product may be transformed into burnt gypsum, or be added to stucco or used as a pigment carrier. Filling substances, such as sand, gravel, stone powder, stone turf, pumice stone, Kieselguhr, ashes, clinker, slags, throat dust from furnaces, asbestos, peat, sawdust, wood shavings, or substances which influence the setting time such as alkali sulphates, alum, borax or glue, or substances which increase the density, such as alum, borax, water glass, etc., or coloring matters, may be added to the calcium sulphate during or after its treatment. R. Schoenhoefer (British Patent 275,788).

## Cement Burning

The material is carried through the shaft kiln by a helical conveyor in which area it is predried and calcined, but not sintered. The sintering takes place in a special wide chamber which is kept at read-heat and the waste gases move up the shaft and effect the calcination. It is known that the material sintered in a rotary kiln must be previously dried in a finely divided condition in a shaft kiln. In distinction to this procedure the inventor claims a lessened height of the shaft is permissible. Andreas (German Patent 446,029).

## Housing Rotary Kilns

Instead of the usual large amount of space required to house a rotary kiln the Karlstadt (Germany) cement Factory has devised a new type of housing for a rotary kiln 200 feet long. This housing is reinforced concrete shown in various cross sections in Figures 3a, b, c & d. Figure 4 shows the complete installation with charging and discharging houses. Foucar (Zement, *16*, 798-799).

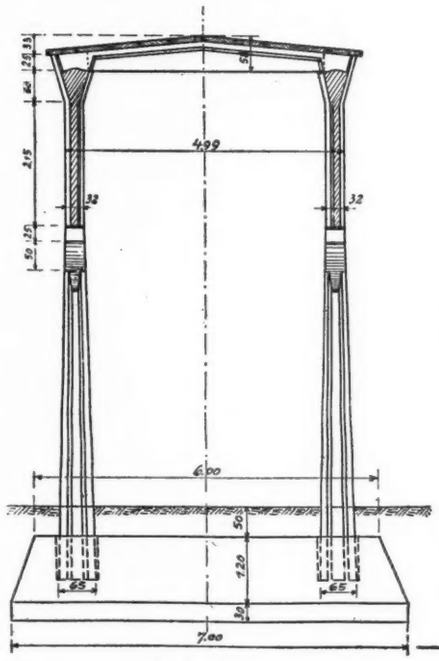


Figure 3a

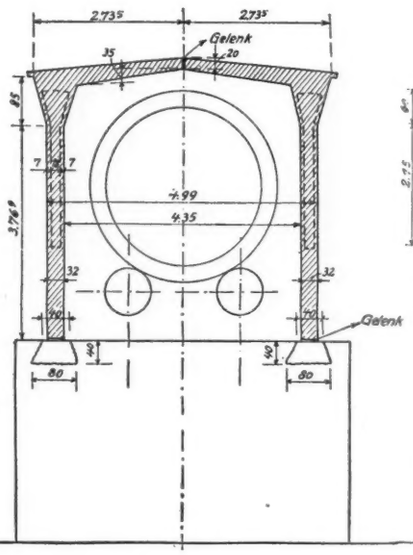



Figure 3b

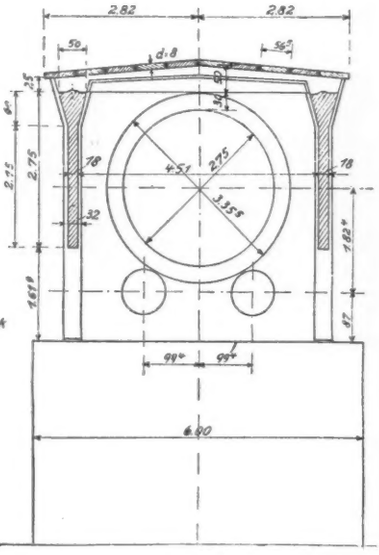


Figure 3c

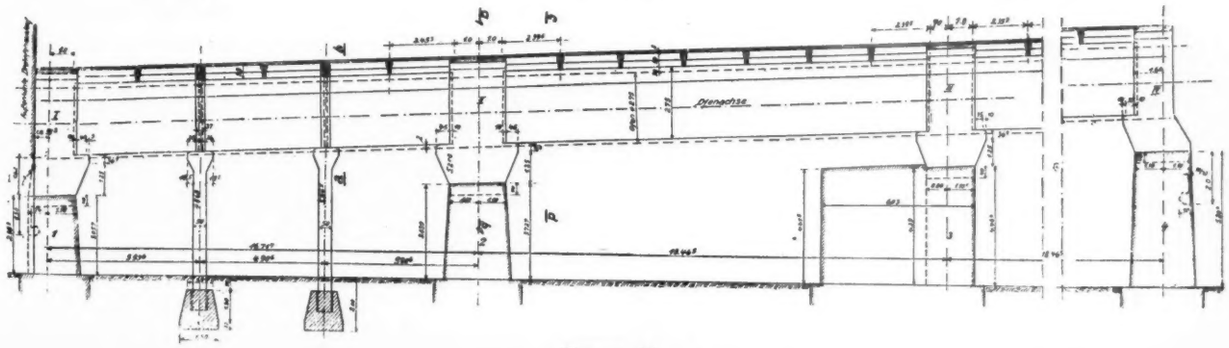
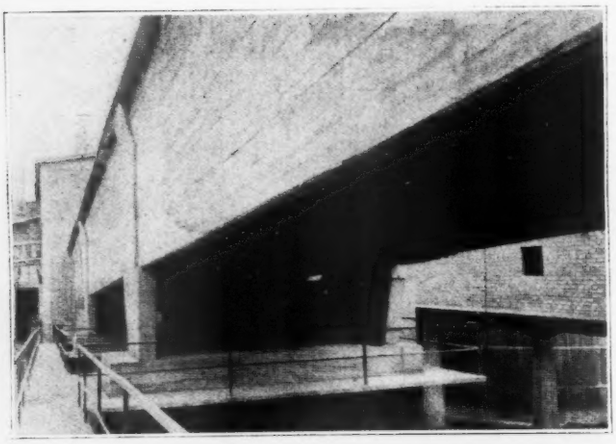


Figure 3d



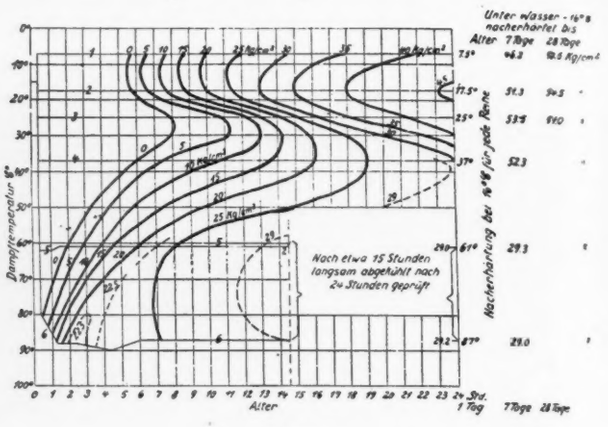

Unter Wasser - 16°C nacherhärtet bis
Alter 7 Tage 28 Tage
Nacherhärtung bei 16°C für jede Reihe
Nach etwa 15 Stunden langsam abgekühlt nach 24 Stunden geprüft
Alter
1 Tag
7 Tage
28 Tage

Figure 1

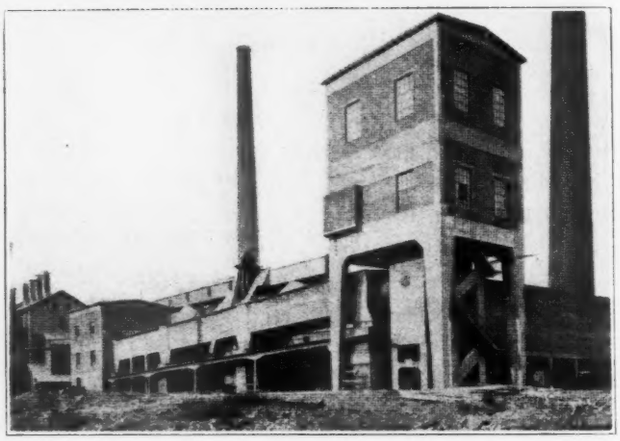


Figure 4

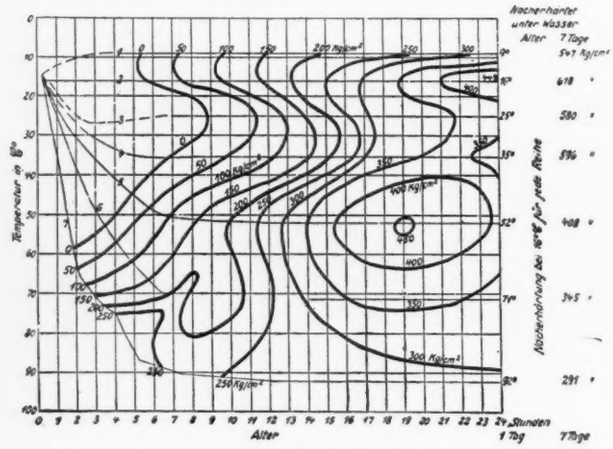



Figure 2

## Fireproof Construction

Burnt clay products including terra-cotta are generally fire resistant, although failure may occur if quartz or silica is present. Lime is likely to cause disintegration in any structure, owing to the dehydration of the calcium hydroxide, followed by a rehydration and expansion on exposure to air and water. Lime-clinker mortars are more resistant than lime-sand mortars owing to part of the lime being chemically combined. Concrete may fail due to its free lime content. Concrete reinforced near the surface is liable to fail owing to expansion of the metal with subsequent spalling of the concrete. A fire-resistant concrete may be made by using an aggregate which will combine with the free lime. Pozzolanic materials such as granulated slag, spent shale, baked clay, etc., are best for this purpose with a fine aggregate composed of red brick or dolerite. Portland blast furnace cement is very suitable for fire-resistant construction. Concrete of this type has the advantage of increasing in strength upon exposure to water after exposure to fire.—Stradling & Brady (Dept. Sci. Ind. Res. Spec. No. 8, 1927, 57 pp. and B. C. A.).

## Temperature and Aluminous Cement

Test pieces hardened in moist steam at 88 degrees 24 hours exhibited a tensile strength of 610 lbs. per sq. in. They were then cured under water at 16 degrees C. After 7 days their tensile strength was 650, after 28 days 660 lbs. per sq. in. The corresponding figures for hardening over water at 61 degrees C. was 594, 610 and 674 lbs. per sq. in. The crushing strength with 24 hours preheating at 90 and 100 degrees C. and then six days curing under water at 16 degrees showed crushing strengths respectively of 5,400 and 4,890 lbs. per sq. in. These results show that a rapid heating is less injurious to the strength than a slow heating, as the temperature curve 7 inches, Figure 2 shows. Figure 1 shows the tensile strength in kg. per sq. cm., at various temperatures, Figure 2 the crushing strength. A. F. Roscher Lund, (Zement, vol. 16, 747-749).

## Porous Concrete

"Gas" concrete is made from lime or a mixture of lime and hydraulic materials such as slate ash, blast furnace slag, brick meal, trass, etc., by mixing these substances with cement and a metal powder, pulverizing the mixture finely, and then gradually added to water which is vigorously agitated in such a manner that the surface of the water is sucked downward. The mixture is then transported in containers which automatically convey the mix to casting moulds. A porous artificial stone results of economic value. J. E. Eriksson (German Patent 447,194).

# SAMPLING DUST BY THE IMPINGER METHOD

By Alden H. Emery,
Associate Geologist, Pittsburgh Experiment Station

THE apparatus for sampling atmospheric dusts consists of a collapsible stand carrying a portable, hand-operated suction pump connected by means of rubber tubing to the impinging device inserted in a sampling bottle, as shown in Figure one.

Suction is supplied by a small rotary-vane pump made as light as possible. This should be calibrated at intervals against an accurate gas meter to obtain the ratio between the number of revolutions per minute and the number of cubic feet of air drawn through the apparatus. The practice has been to use that rate of speed which will draw 1 cubic foot of air a minute against the resistance of the impinger adjusted as described later.

The impinging device (see Figure two) consists of a ½ inch glass tube, 8 inches in length, drawn down sharply at one end to an orifice 2.3 millimeters in diameter. A 1-inch bronze disc is supported 5 millimeters from the end of this tube. The whole device is inserted in a 2-hole rubber stopper, in the other opening of which is a short glass tube of the same diameter connected to the suction pump with a rubber hose. A 16-oz. wide-mouth laboratory bottle taking a No. 8 or 9 rubber stopper is used. In this 150 to 200 c.c. of liquid is placed and the impinger inserted, extending nearly to the bottom. When suction is applied, the dust-laden air is drawn in through the glass tube, the dust impinges on the wet brass plate at the bottom at high velocity and floats off in suspension in the surrounding liquid.

Owing to the various solubility effects possible when dealing with mixed dusts, no matter how great care has been observed in the selection of the liquid medium, samples should be sent promptly to the laboratory and analyzed as soon as possible.

Rubber stoppers have been found to prevent leakage from the sample bottles better than any others. As the purpose of this kind of sampling is to detect and quantitatively measure the kind, size, and amount of atmospheric dust, the presence of any solid matter in the original sampling solution is extremely deleterious. Ordinary friction tape is the most satisfactory material for sealing bottles for shipment.

## Selection of Sampling Point

The selection of the point of sampling is important. In general, each sample should be planned to give some definite piece of information or data pertinent to the study or investigation. If the purpose is to determine the dust breathed by a man under definite working conditions, the sample bottle, equipped with an extension hose, should be held by an assistant as near the nose of the worker as possible. If it is in a ventilation current the bottle should be moved about to traverse the entire cross section. If informaiton is desired regarding the dust raised by some single operation, caution should be exercised to see that no other operations affect the dust produced. For example, a sample collected in a quarry during dry drilling alone means more for comparaison than one taken while men are drilling both wet and dry or with rock being shoveled in the vicinity.

Fig. 1

## Collection of Samples

As a rule, it is easier to carry the impinger pump assembled for use than in the dismounted form in which it is shipped. When ready to take a sample, the bottle is unsealed, the stopper remover, the im-

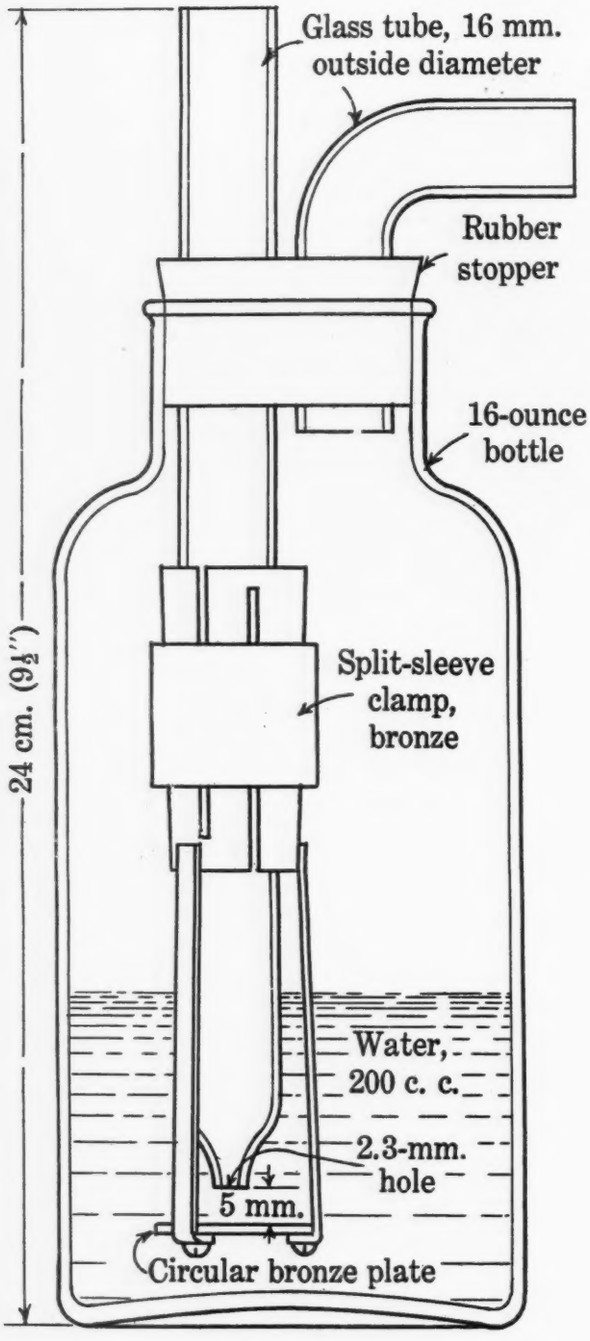



Fig. 2

pinging device inserted, and connected to the pump, and the whole clamped to the stand if so desired. All is now ready for sampling. Care should be taken in the preceding steps to prevent contamination of the sampling solution with dust. Bottles should never be allowed to stand open; the impinger should be carefully protected from dust between different samples and the shipping stoppers should be similarly guarded during collection.

The impinging device should be carried in a spare bottle containing the same solution used for sampling. This acts as a rinse for the impinger between samples. While the impinger is in use, the stopper from the sample bottle may be put in this rinse bottle, thus protecting the solution and the stopper from external dust. The rinse should be renewed as soon as contaminated with dust, probably at least once a day unless samples are collected in almost dust-free air, under which conditions it could be used again, or unless collection is done in extremely dusty air, which would necessitate more frequent change of rinse.

The period of sampling varies in relation to the concentration of dust in the atmosphere; 15 minutes is necessary for ordinary dusty air. The more dust present the shorter the sampling period, and the lower the concentration the longer the sampling period. The correct balance between concentration and period of sampling can only be obtained by experience. If the evaporation of the collecting liquid is excessive and reduces the amount ¼ to ⅓ (likely to happen only when alcohol is the liquid medium and sampling is continued over long periods) more solution can be added from another bottle to restore the amount to normal.

After sampling, the impinger should be removed from the bottle, first agitating in the liquid to prevent dust from adhering to the tubes. This movement of the liquid can be induced by shaking and if necessary, gentle blowing through the dust intake side of the impinger. The stopper is quickly inserted and the bottle sealed and packed for return to the laboratory.

After sampling and before going to the next place of collection, small stoppers should be inserted in the intake and outlet tubes of the pump to prevent solid particles from getting into the blower. More trouble has been experienced in the past from such fragments falling into one of the openings or being picked up when the instrument has been laid or fallen against dirty walls or on dirty floors than from all other causes. These plugs should not be removed until just before sampling.

### Recording Conditions

Careful records should be taken immediately after collecting each sample to include all pertinent data. It is almost impossible to obtain too much specific information regarding the conditions in the place of sampling and general information of the mine or factory as a whole. Results are often vitiated through lack of good data.

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## Best in the Field

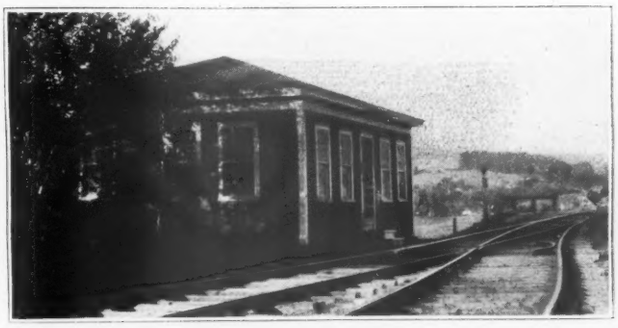
Gaylord E. Gray, manager of the Des Moines Sand & Fuel Company, Des Moines, Iowa, writes: "We wish to compliment you on the magazine which you are now publishing, which in our opinion is the best in the field and certainly the most interesting from the sand and gravel standpoint. During the last year we have given our opinion as above stated to several machinery houses, who have requested our opinion in this matter."

# ECONOMY AND QUALITY ATTAINED TOGETHER IN PRODUCTION OF TALC

By F. A. Westbrook

OF THE three operations of the Eastern Magnesia Talc Company, that at Johnson, Vermont, produces the finest grade of material. When anybody speaks about a talc mine one's thoughts naturally seem to turn to talcum powder and although a grade of sufficient excellence for such use is turned out here, it is only a small proportion of the whole. In fact, talc is used in large quantities by tire manufacturers, the rubber insulated wire companies, large paper manufacturers and cotton bleacheries, as well as other industries. Talc crayons are another product. A large quantity of material which was once waste is now sold for roofing papers. Thus it is evident that the output from a talc mine has a wide application in which toilet preparations play only a rather small part. The production of this plant alone is 70 to 100 tons per day, and, since the installation of the Hardinge mill, it is the largest operated by this company. (The Rochester, Vermont, plant was described in the Dec. 1st, 1925, issue and the Waterbury, Vermont, plant in the Feb. 15th, 1927, issue of Pit and Quarry.)

The talc ore occurs in lenses in schist with intrusions of serpentine. The latter often form very inconvenient obstacles in the mine and when it is impracticable to go around them the rock must be removed resulting in considerable expense and annoyance. However, this is merely a part of the game. The mine from which the raw material is now obtained is located on a high ridge about 3½ miles from the plant. Formerly the sources of supplies was a mine adjacent to the plant but this has been abandoned.



Office Building for Plant

This a shaft mine, the shaft being about 325 feet deep with stopes at three levels. The mining method was formerly room and pillar but now shoveling and stoping partially displaces this method. The skip is operated by a Mead Morrison hoist equipped with a 60 h.p. General Electric slip ring motor. The skip is dumped into bins at the mine head and from these the material is loaded into horse drawn trucks which carry it down to the mill. Sleds are substituted for trucks in winter.

In the mine drilling is done by Ingersoll Rand jack hammers and stopers. Compressed air is supplied by a motor-driven Worthington Laidlaw compressor. Of course drilling in such soft rock is an easy matter from the standpoint of keeping the drills sharp. In fact, the same drill can ordinarily be used for a week without any attention whatever. The mine is kept dry by means of two Worthington pumps. All machinery at the mine is electrically driven, as has been indicated, and the interior of the mine is electrically lighted. Power is supplied from an outdoor transformer station. The machin-

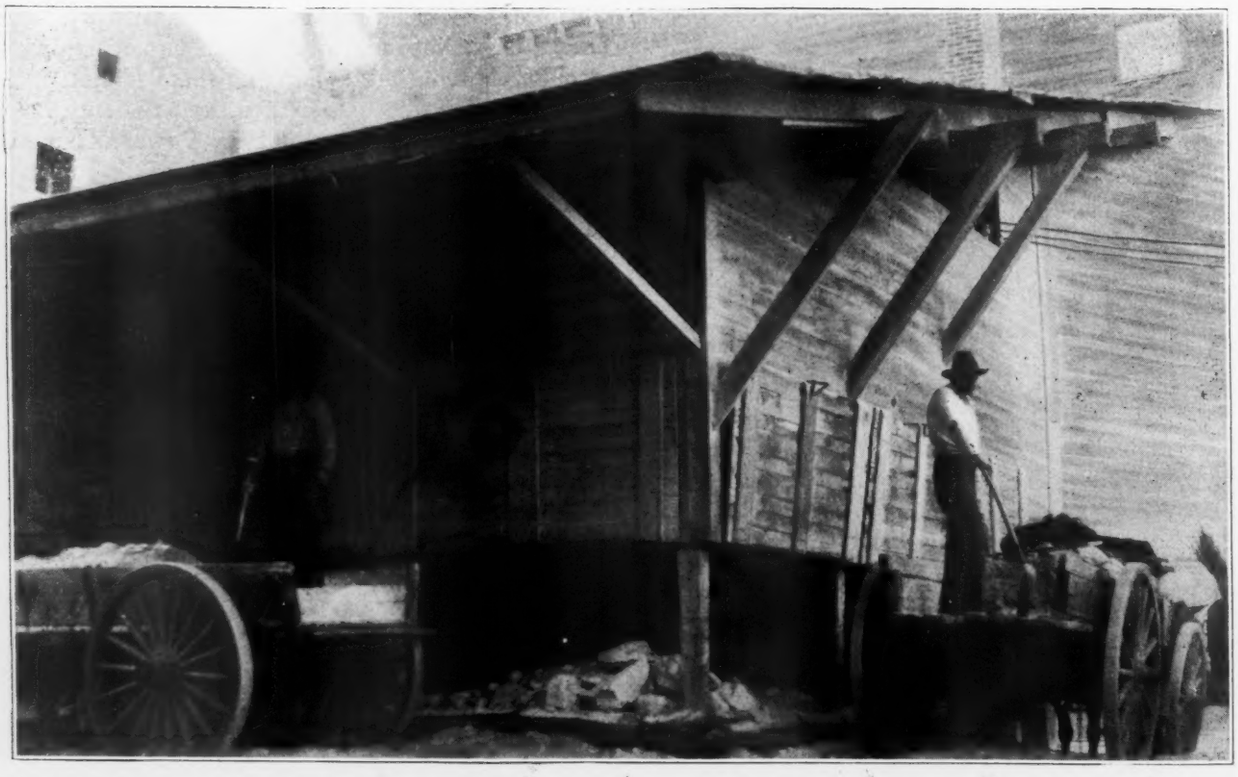
View of Mine Head with Storage Bins at Rear Where Trucks Are Loaded

One of the Grinders in the Plant. Bill Driscoll, Foreman; Frank Samelle, Machine Operator.

ery in the mill, together with the equipment for mechanical handling, is well planned. Some of the newest units are of the most modern type and provide an excellent opportunity to compare their performances with some of the older models.

When the ore is brought to the mill it is shoveled into a large sheet metal lined hopper, the top of which is at ground level. From this it is fed by a Jeffrey feeder to a 15 x 24 Traylor crusher. A Jeffrey elevator takes the ore from this point to a Walker and Elliott rotary crusher; and a belt conveyor with a Goodyear belt and Jeffries idlers, conveys the ground material to another Jeffrey elevator, which, in turn delivers it to a trommel screen at the top of the mill.

The function of this screen is merely to separate



Unloading Truckloads of Talc at the Plant. Due to the Possibility of Contaminating the Crude Ore with Road Mud, Dust, Etc. Dropping Off the Wagons and Thus Affecting the Desired Purity of Color, It Is Not Feasible to Use Bottom Dump Wagons or Permit Any Vehicle to Pass Over the Bin. Loaded Wagons are Covered with Paulins to protect the Crude Ore from Rain, Mud and Dust

the small sizes which need drying from the larger sizes which do not need drying. Thus the overs from it pass through a chute to a storage bin and the throughs by another chute to a Ruggles-Coles cylindrical dryer. After passing through the dryer the ore is taken by a vertical Jeffrey elevator to the same storage bin as the overs. This bin has a capacity of 350 tons and it is from here that all material for the subsequent milling processes is drawn. It holds enough to keep the mill running for several days in case the roads from the mine become impassable with snow. Furthermore, there is a very considerable storage capacity in the bins at the mine head and also at the mill so that the latter can be run for some time under almost any contingency which might cause the suspension of production at the mine or interfere with transportation between the mine and the mill.

From the storage silo or bin the crude ore passes by chute to one of three grinders. The newest and most satisfactory of these is the Hardinge mill and for the sake of clearness we will omit the others and follow the material which goes through this. It might be said in passing, however, that the performance of this Hardinge mill is so economical and generally efficient in all respects that more units are likely to be installed in case of expansion.

The pulverized ore from the Hardinge mill is taken by a Jeffrey elevator to a Raymond air separator. The air pick-up carries the standard talc to an elevator delivering to a Jeffrey screw conveyor over the four silos for the finished products. This screw is, of course, so arranged that the talc may be dropped into any one of the silos. Under these there are Howes baggers and a Bates Valve bagger as shown in the flow sheets. Howe scales are used with this former.

Rejects from the air separator drop to an elevator which discharges into a storage bin. The other pulverizing mills discharge through other air separators into this same bin. When there is a sufficient accumulation of this material, it is drawn off on a belt conveyor to an elevator and the latter deposits it in a silo over a Raymond mill. When reground it drops into a second Raymond air separator. There again the air pick-up carries the good material to a second screw conveyor, parallel to the first, over the bagging silos. The rejects from this mill contain the roofing paper material plus some fine talc. The mixture is taken in a screw conveyor to a chute through which an air current passes. This current takes the fine talc up to one of the silos but permits the heavy magnesium carbonate to drop down to where it is picked up by an elevator and carried to a Newago screen. The commercial size is dropped into a silo from which it is bagged, the rejects being returned by chute to the Raymond mills.

This completes the cycle of operations. As a matter of fact each of the other pulverizing mills has its air separator and there is a rather complicated but ingenious arrangement of chutes and valves whereby any mill may be associated with any air separator. Also, there is another system of chutes, making it possible to return the rejects from the Newago screen to one of the other pulverizers. In other words, the chutes, consisting mainly of wood lined with galvanized iron plate, have been so laid out that a very great flexibility has been secured. This not only insures at least partial production under any but the most untoward conditions, but also makes it possible to intensify production on those grades of material for which the demand is most active at any given time.

View of Plant Showing Railroad Siding and Waste Disposal Conveyor at Right

The mill is heated by means of an American Radiator Co. steam boiler. A small motor-driven Ingersoll Rand air compressor has also been provided to supply air for removing dust from the motors every week. The motor which is used for this is merely the one used ordinarily to drive the Traylor crusher and is belted temporarily to the compressor when it is desired to run it. Most of the electrical equipment has been purchased from the General Electric Company. The motors are all induction motors, 220 volts, and of the following sizes for the various machines:

| H.P. | Machines Driven |
|---|---|
| 15 G. E. | Howes Baggers |
| 10 G. E. | Bates Valve Packer |
| 50 G. E. | Raymond Mill |
| 10 G. E. | General Drive on Shop Floor |
| 10 Westinghouse | Main Elevator |
| 25 G. E. | Rotary Crusher and Crusher Elevator |
| 40 G. E. | Traylor 15 x 24 crusher |
| 50 G. E. | No. 11 Raymond Blower |
| 40 G. E. | No. 11 Raymond Blower |
| 40 G. E. | No. 8 Raymond Blower |
| 20 Westinghouse | Crushing Rolls |
| 75 Fairbanks-Morse | Hardinge Mill |
| 40 G. E. | Buhr Mill |
| 15 Westinghouse | Ruggles Coles Dryer & Elevator. |

12 other motors on miscellaneous drives and for spare

The plant is situated close to the line of the St. Johnsbury and Lake Champlain Division of the Boston and Maine Railroad. A siding has been extended alongside the mill and the bagging machines are located adjacent to the loading platform. The office is located in a small separate building.

## What It Means to Replace Men with Machinery

The extent to which machinery has increased our operating efficiency and the productivity of our industrial plants during the last ten years is well illustrated by a recent survey showing the decline in the number of men necessary to complete a unit of production.

The steel industry provides an excellent illustration. In furnace charging two men now replace fourteen. In pig iron casting, seven men replace sixty. In unloading pig iron, two men replace 128 while in open hearth operation, one man replaces forty. In the glass industry, machinery has increased the average hourly output per man from 77to 3,000 in the case of 4-ounce glass bottles, and from 54 to 2,300 in the case of electric light bulbs.

According to Bureau of Labor statistics, the productivity per man increased, between 1914 and 1925, 172 per cent in automobile manufacture, 40 per cent in flour milling, 83 per cent in petroleum refining, 211 per cent in rubber manufacturing and 61 per cent in cement manufacturing. This tendency has been accompanied by a decrease in price levels, an increase in wage levels, and an increase in industrial earnings, indicating the threefold benefit to be gained by the replacement of hand operations by machine operations.

## Watch Calcium Chloride Experiments on New Brunswick Roads

New Brunswick has been experimenting in the use of Calcium chloride for settling the dust on roads and streets in a number of towns during the present year. The city engineer of Fredericton estimates that the cost of doing the job with this material is less than oiling. The use of oils has not given the results anticipated, and in addition the approximate cost is $1,000 per mile for applying. Calcium chloride is being applied to all the more densely traveled gravel roads at the rate of about 2½ pounds per square yard, made in three applications during the season. The material was imported at a landed cost of $38 per ton. Thus the unit cost can be figured roughly, allowing 2½ pounds per square yard for the season. The cost per ton of the imported product is considered lower than that imported from the United States. The cost of spreading is figured roughly at $1.00 per ton if a machine drawn on a trailer behind a motor truck is used. It is the opinion of the Deputy Minister of Public Works of New Brunswick that the cost of attempting to banish the dust from the Provincial roads is at the present time prohibitive, inasmuch, as the use of calcium chloride does not go any distance in preserving the surface of the roads.

## Wisconsin Aggregate Association Plans Ninth Annual Meeting

The Ninth Annual Meeting of the Wisconsin Mineral Aggregate Association will take place in Milwaukee, December 7th and 8th at the Astor Hotel. The meeting, covering two days, will begin Wednesday morning in the form of registration and getting acquainted with a welcoming luncheon at noon.

Wednesday afternoon, Thursday morning and Thursday afternoon, will be devoted to papers and discussions of interest to our industry, closing Thursday evening with the Annual dinner dance and entertainment.

# CRUSHERS AND THEIR COMPONENT PARTS

By Wm. T. W. Miller

Part X

PARTS one to nine, inclusive of this series of twelve articles have appeared in the past nine numbers of Pit and Quarry. In them Mr. Miller describes mechanisms applied to jaw crushers, jaws and cheek plates for rock crushers, toggles and toggle bearings, lubrication, the gyratory crusher, and roll shells and centers for crushing rolls. In the tenth article, which begins below, Mr. Miller continues the subject of crushing rolls.

Mr. Miller, the author of this series, has had thirty years' experience as a specialist in crushing machinery. For the last twenty-six years he has been employed by Hadfields, Ltd., of Sheffield, England. For the past eighteen years he has been engineer-in-charge of their crushing machinery department. He has studied crushing problems in the United States, Canada, Brazil, Uruguay, Argentine, France, Spain and Portugal.—Editor.

## Bearings and Lateral Adjusting Devices for Rolls

Fig. 11 illustrates the parts of the movable bearings used in the Type "AA" Rolls made by the Traylor Co. The slide-ways on the carriage are arranged in a special manner, the projecting keel on the base of the bearing working in a large recess in the bedplate. No provision is made for any swivelling movement but the front end of the cradle is clamped down to the frame-slides by an anti-chattering device consisting of a bell crank lever and spring not shown, which is hinged by a pin passing through the boss below the hole for the tension-rod.

A loose bearing-casing is shown and a removable cap lined with babbitt metal and including an oil or grease box of ample size. It should be noted that the bearing is split on a line about ten to twelve degrees from the horizontal and not at the customary forty-five degrees angle. When rolls were operated at low speeds the wear on the crushing surfaces was not excessive and the removable shells did not need to be changed at frequent intervals. The change to high-speed crushing brought about a rapid increase in the wear and tear on the roll-shells and a ready means for changing these pieces became necessary.

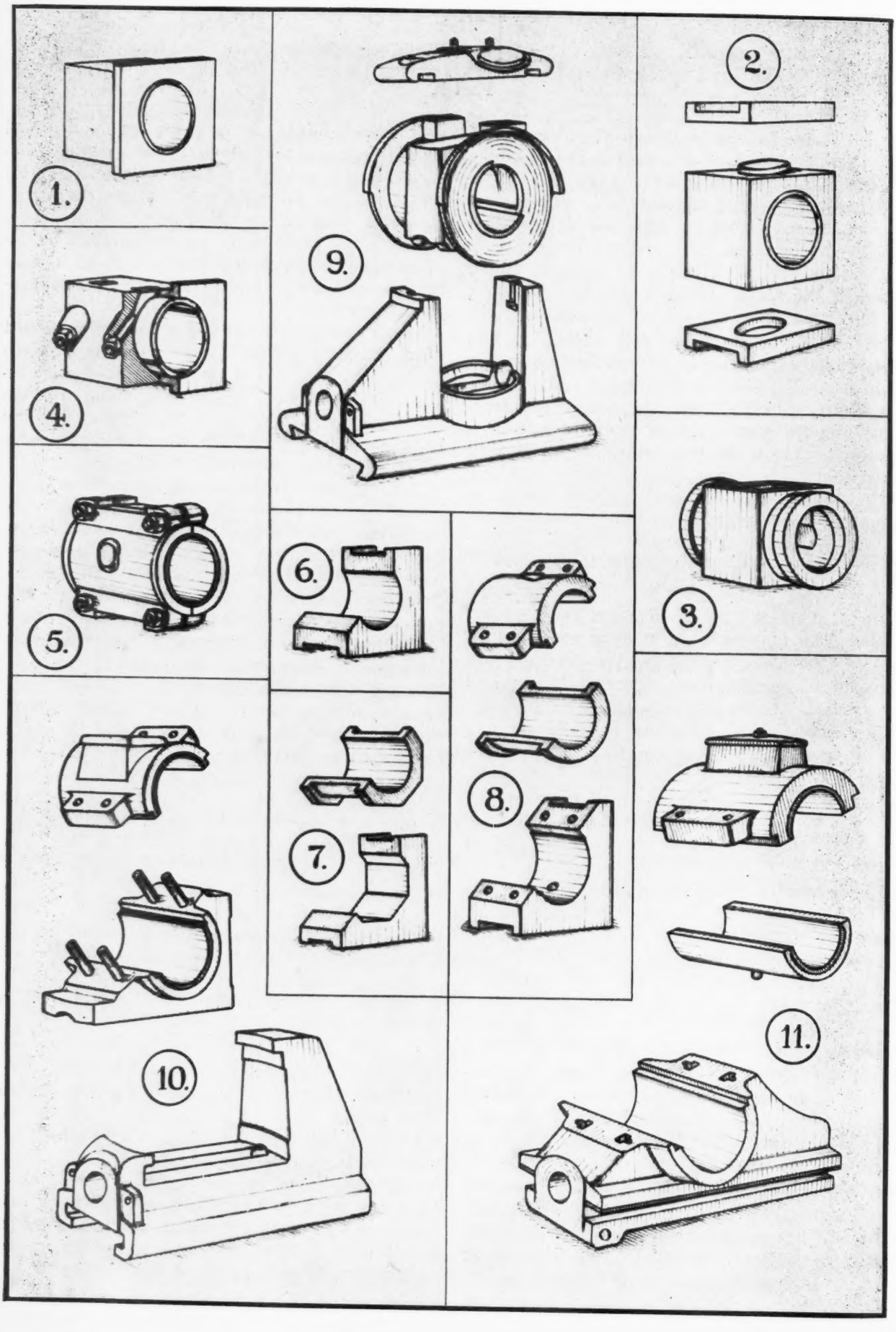
Krom introduced the system of securing the shells to the shaft by double conical centers, one half-center being a fixture on the shaft whilst the other was slideably mounted. With increasing speed, and the necessity for a firmer grip on the shell, the wedge-angle of the cone had to be reduced to such an extent that it was extremely difficult to ensure the accurate placing of the shell on the fixed half of the center, and the first setting might be disturbed by any subsequent tightening process, with the result that the rolls were not exactly in line with each other. When the opposing roll faces were not matching properly flanges were formed on the overlapping edges which were a serious impediment when the spacing had to be changed to compensate for wear.

There was always a tendency for the outermost edges of the rolls to wear less than the body of the shells. This was due to the cheek-plates which reduced the density of the stream of material in the outside edges of the ribbon. This type of flanging must not be confused with that mentioned above which is due to improper alignment.

In some cases the roll and shaft could be moved bodily sideways and secured by loose collars on the shaft, but this was a troublesome and ineffective process and engineers quickly realized that a more positive construction was desirable. It was not thought necessary to provide special means for side displacement on both rolls but the practice of fitting an independent mechanism for end adjustment of the fixed-roll shaft became very general.

One of the earliest of the lateral adjusting devices is shown in Fig. 12. A stud bolt was screwed into the end of the shaft and projected through a circular cover-plate which was attached to the end of the bearing by three stout screws. Between the inside of the cover and the end of the shaft a thrust washer was inserted which could be adjusted forwarded by three setscrews fitted with lock nuts. The shaft was pulled into contact with the thrust washer by means of the central bolt which had double nuts and a heavy washer on the screwed portion outside the cover-plate. By careful regulation of the screws pressing against the thrust-plate and the lock nuts on the stud bolt the shaft could be moved laterally in a limited travel and secured in the desired position.

Fig. 13 shows the side-adjustment used for many years in the Allis-Chalmers Style "B" Rolls. The shaft revolving in the stationary bearings had a wide groove formed in one end in which was clamped a split adjusting-block with semicircular wearing plates screwed on the internal faces bearing against the collars on the shaft. The halves of the block were held together by fitted bolts and holes were cored in the wings of the casting in which were inserted two long adjusting screws passing through the frame in the vicinity of the bearing. The regulating bolts were threaded for a considerable length and had nuts on both sides of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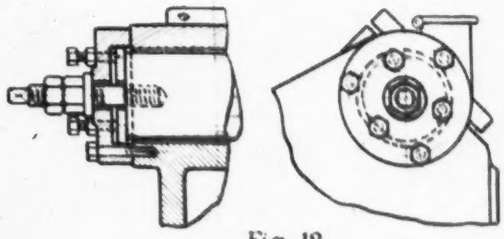

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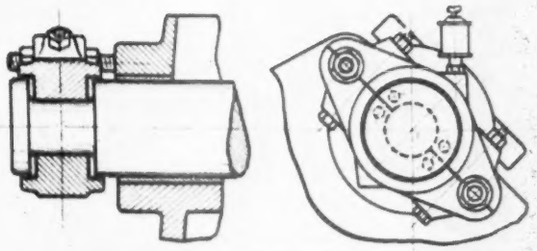

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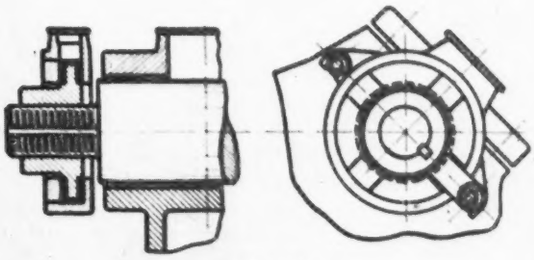
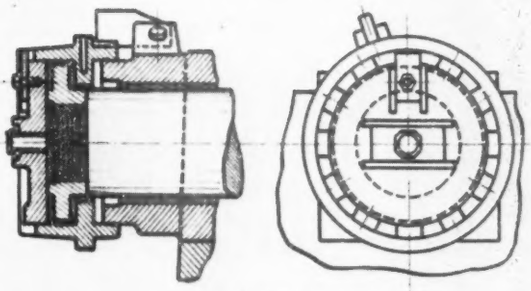


Fig. 14.



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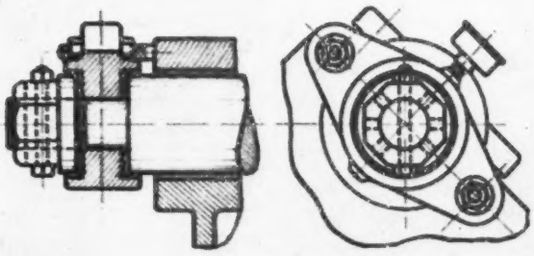

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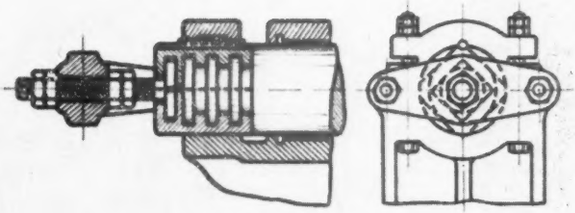

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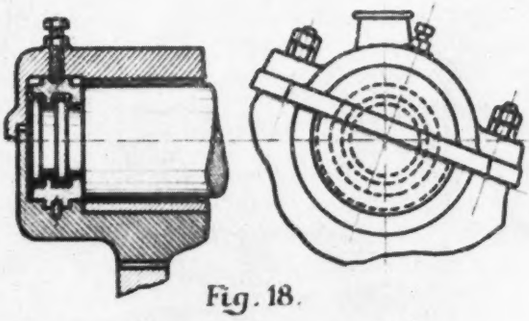

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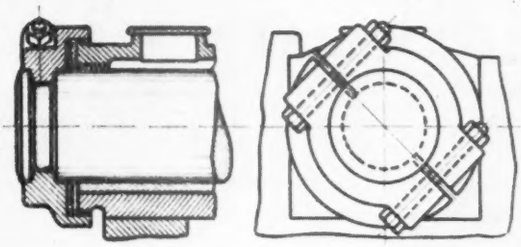

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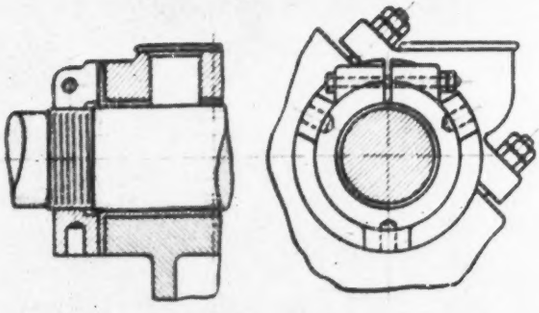

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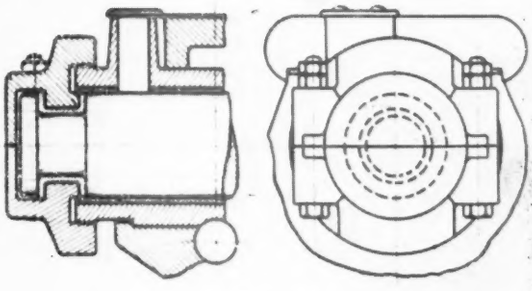

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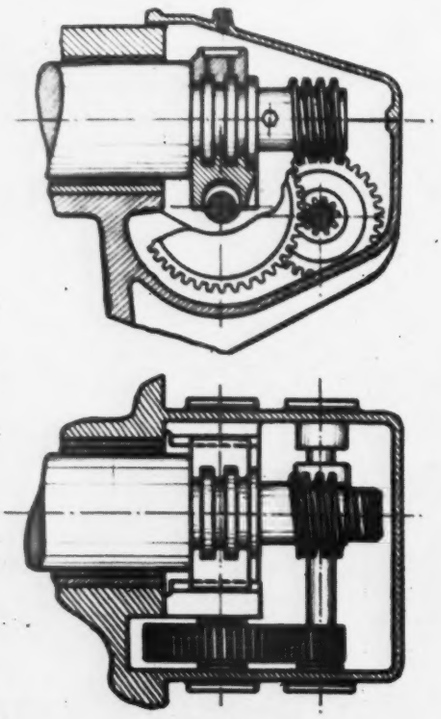

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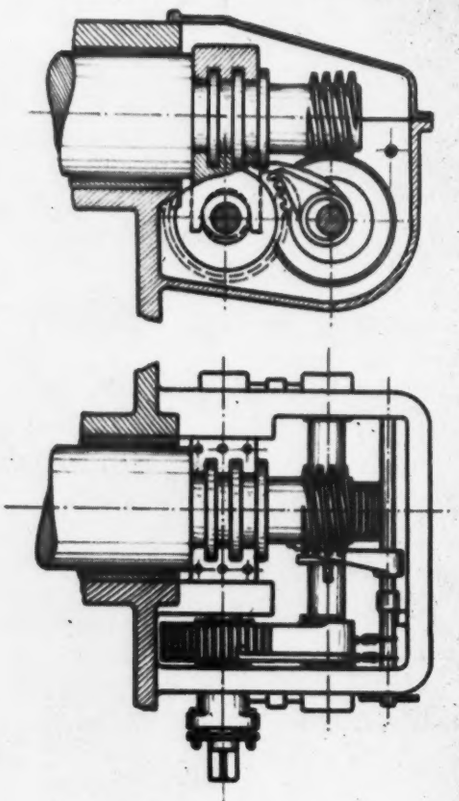

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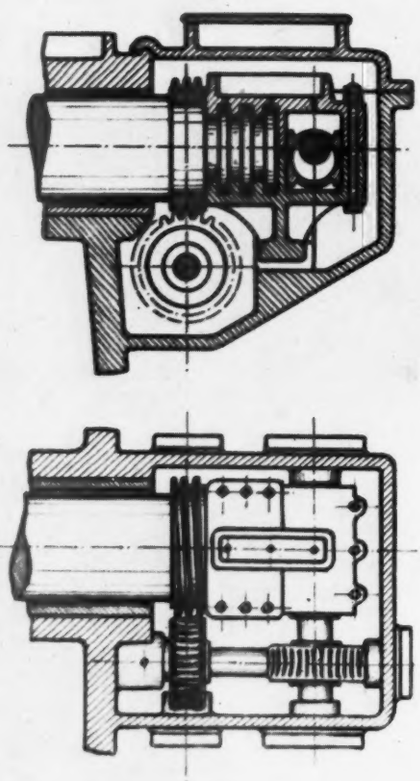

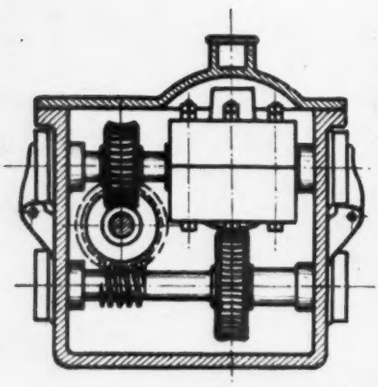

Fig. 24.

the adjusting-block so that, using the frame pillar as a rigid base, the shaft could be pushed or pulled sideways by means of the screws.

In this last-mentioned design any slackness due to wear on the thrust block could only be made good by inserting thicker wearing plates on the rubbing surfaces and to overcome this difficulty the Power and Mining Machinery Co. introduced the mechanism illustrated in Fig. 14 for their "Superior" type rolls. The end of the shaft was reduced in diameter and screwed to receive a large nut with a circular flange which formed an adjustable collar. Renewable bronze washers were pegged to both sides of the flange.

The collar revolved inside a thrust-box which was bolted to the side of the frame in a similar manner to that shown in Fig. 13, except that, in this case, the box was stationary and the connecting screws were not used for the purpose of adjustment. The circular cavity in the thrust-box was closed by a screwed outer cover which passed freely over the nut and was locked in the desired position by a key-plate on one of the frame bolts. The width of the recess could be regulated by means of this outer cover to compensate for the reduction in thickness of the bronze rings under wear. With this device the shaft was moved endways by screwing the collar-nut in either direction as required, a key being inserted between the shaft and the nut as a locking medium.

The Gates High Grade Rolls were fitted with the system of side-adjustment indicated in Fig. 15. The journal-boxes for these rolls were cast in one piece without a loose cap and the outer end of the bearing from which the adjustment was made was threaded to receive a large ring-nut with an internal flange having a bore approximately equal to the journal diameter. A screwed plate was inserted in the outer end of the ringnut and the cavity between the flange and plate was filled by the collar which was screwed on the end of the shaft and keyed to prevent independent rotation.

The collar was protected by bronze wearing-rings on both sides, and the screwed end-cover and the ring nut were locked in place by latches or keepers. The ring-nut and cover could be turned together in either direction by means of a lever, and the side-displacement on the screw connection with the bearing would cause the shaft to move endways as required. If so desired this adjustment could be made when the rolls were in operation.

Fig. 16 shows a modified type of the contrivance illustrated in Fig. 13. The solid collar on the end of the shaft in the earlier arrangement was replaced by a collar-nut so that the width of the recess between the shoulder on the shaft and the end-collar could be adjusted at will by turning the nut, which was secured in position by a locking bolt. The bridge casting for the thrust-box was simplified as it could be made in one piece and passed over the end of the shaft instead of being made in halves as formerly. The adjustment of the roll-shaft was carried out in a similar manner by means of the wing-screws securing the thrust-box to the frame.

Some of the early Traylor Rolls were fitted with a thrust mechanism as shown in Fig. 17. An extension-bracket with a loose cap and a circular bore projected outside the roll-bearing, and the shaft was reduced in diameter at the end and grooved to form a number of thrust collars over which fitted a bronze sleeve in halves; the sleeve was a sliding fit in the bracket and secured against rotation by a feather key. The outer end of the sleeve had a square pocket in which was inserted the head of the adjusting bolt, and the screwed portion of the bolt extended outwards through the boss of the stirrup-shaped casting which was rigidly connected to the sides of the bracket. The situation of the sleeve, controlling the position sideways of the roll could be changed by means of the lock-nuts on the thrust-bolt.

The later Traylor Rolls are frequently fitted with an automatic side-traversing or "fleeting" device on the fixed-roll shaft, of which more will be said later, in which case the shaft for the movable roll is provided with non-adjustable thrust collars as shown in Fig. 18. The renewable sleeve is split to pass over the thrust-collars, the lower half being held by a dowel-peg and the upper by a pinching screw through the cap.

In certain classes or rolls, in which the regulation of the endways position does not require constant attention, the centering of the shells is accomplished by means of split-collars and distance washers arranged as indicated in Fig. 19. The collars are halved and bored to fit in circular grooves in the ends of the shafts; to exclude the dust they are also cast with flanges which overlap the ends of the bearings. Thrust washers of varying thickness are inserted between the inner faces of the collars and the outer ends of the bearings and the position of the roll is determined by changing the packing rings.

It is obvious that for this system to be effective collars must be fitted at both ends of each shaft which is not always a simple matter.

The screwed collars, shown in Fig. 20, are easier to adjust than those outlined in Fig. 19, but are more liable to jar loose under the vibrations of the rolls. Their efficacy depends entirely on the locking bolts and, should these slacken, the driving effect of the rotary movement may cause the collars to grip the bearings too tightly or loosen their hold entirely.

Fig. 21 illustrates the system of thrust collar and side-adjustment used in the Worthington "Garfield" rolls. The journal-boxes are of the solid carbox type and are threaded on their outside ends to receive the adjusting-cap in a similar manner to that adopted in the old Gates high grade rolls. The

thrust-cap is divided horizontally and fitted with an internal bronze liner in halves which is shaped to correspond with the contour of the end of the shaft. No provision is made for taking up any slackness which may arise due to side wear on the bronze faces and when this reaches a serious amount the liners have to be renewed. The outer collar or adjusting nut is locked by a drop-latch which is not shown in the illustration and the slots in the periphery serve as holds for the spanner used for the purpose of adjustment.

It should be noted that, in the larger machines, adjusting collars are fitted on both shafts so that the rolls may be kept central instead of the adjustable roll being compelled to follow its mate should the latter be badly out of center. The deterioration of the crushing surfaces is the most serious drawback to the use of rolls as secondary or fine crushers. The roll shells may wear hollow or circumferential grooves are formed and there is always the tendency for flanges to appear before the shells are worn out. Irregular wear across the width of the roll is usually due to uneven density in the stream of ore and this can be overcome by an automatic feeder or any similar regulating device such as a belt-conveyor.

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## Crystal Structure of Cement Clinker

About 30 slides and also powders were subjected to crystallographic—optical investigation were made of the most important clinker minerals, Alite and Belite. Alite was found to consist of weakly small axial angles of negative character to the double refraction. The refractive index was found to be 1.715. Belite consisted of strongly double refractive crystals with positive character of the double refraction, variable axial angles and variable color. Refractive index—Alpha line—1.715 gamma 1.735. The strongly colored material, the corresponding Celite exists in isotropic form whose properties require further investigation. Free lime crystallizes out in the form of Deudrite. $\beta'$—Bicalcium silicate (?) exists in the form of large optically positive crystals of weak double refraction which resemble the compound mentioned up to the higher refraction. Colorless glass was found, often in noticeable amount. Isotropic grains of aluminates were present in at least one case. Alite is concluded to exist as mixed crystal formation of tricalcium silicate with varying amounts of tricalcium aluminate. Belite corresponds most probably to $\beta$- or $\alpha$-bicalcium silicate with varying iron and magnesium content. The content of Alite exerts an important effect on the beginning of the hardening period. Guttmann & Gille (Zement, Oct. 6, 1927) pp. 851-953, and Sept. 29, pp. 921-924).

*(continued from page 70)*

sow any time. These bins cost about the same as bags.

We move our plant several times a year, having two communities in which we operate. We expect next year to have three. This is our principal argument to get orders out of season. We urge the necessity of laying in while we are in the community or otherwise paying much more to get lime from the outside after we are gone. We find it works and thus enables us to move our product practically all year around.

Our product is fine and uniform. We use a hammer pulverizer 12 inches wide with 22 inch diameter cylinder run at 1800 r.p.m. with bars spaced ⅛ inch apart. A tight elevator is attached to elevate the material on to a simple screen 16 mesh to the inch. The screen on that is high enough to allow the oversize to flow back into the pulverizer. Thus the entire product passes the 16 mesh screen and is always uniform. Stones 5 inches and under are fed into the machine. The machine, running at high speed, makes a very large percentage of 100 mesh product. Our machine is all steel, designed and built by the writer. We wanted a compact, high speed, quality machine with elevator and screen built on as a complete unit for quick moving and set up at the several locations. Boiler plate, heavy size cut to size and then welded by electric welding process makes up the frame and cover throughout. The writer having previous connection with manufacture was able to make this machine to embody the desirable features of older machines and added the improvements called for to our purpose.

We use steam power, an 8x10 Peerless rated 14 h.p. but equal to 35 brake horse power gas or kerosene. We use an 8 inch by 125 feet endless belt from engine to pulverizer. Drilling is by Cleveland jackhammers using steam instead of air. Only two or three four-foot holes per day are required and thus a little steam from our boiler is sufficient. We save the cost of a compressor and power to drive it and have less machinery to move when we do change the set-up. Our bin is on posts 8 feet high to allow room for big trucks to back under. A platform at one side with roof over it is used for bagging and to store some bagged material.

The stone is brought from the quarry in a Ford truck with a simple low dump body. We find that light trucks with pneumatic tires are best for delivery to farmers. Our capacity is 3 tons per hour maximum. We average 2 to 2½ tons in regular practice. We do not always run full capacity during the off season but rather with as light a crew as practical and keep them busy daily. During the rush we add a few men and step on it to get the most output at the regular price.

# ACTION OF ADDITIONS OF FLUORIDES TO GLASSES AND ENAMELS

By G. Agde and H. F. Krause*

Part II

PART one of this article dealing with an investigation by German chemists into the opacifying of enamels and glasses by the action of fluorides appeared in the September 14th issue of Pit and Quarry. The following installment is a continuation of the description of research work done on this subject.—Editor.

Those glasses which chilled clear were heated again slowly in a small electric furnace in which the opacity began to appear at a certain temperature; this point could be determined quite accurately as the mass was suitably illuminated. The temperature was measured by a platinum: platinum-rhodium thermoelement inserted amongst the particles of the charge.

The thermal treatment of melts I and II is shown in Table I as well as the manner in which the glass became opaque.

For the optical investigation of the opaque masses prepared thus about 50 thin sections were made.

In every section it was unmistakable that the opacity was caused by the deposition of a substance in the solid state. Uniformly distributed small bubbles, such as would necessarily be present if the opacity was caused by included gases, could not be seen in any case. With regard to the bubbles noticed by Otremba[10] the following must be stated: Perhaps gases were actually enclosed in his melts which were not driven off at the very low melting temperatures used by Otremba. According to his description he was dealing with frits rather than with completely melted glasses. In such a case the bubbles cannot be considered as of primary importance in causing the opacity as the uniform distribution and size prerequisite to a good opacifying effect cannot be obtained and according to the description was not present. Another explanation is that an error of observation was made; probably the use of a higher magnification would have shown that a crystallized substance was chiefly present.

The sections of melts I and II were with certain exceptions uniformly filled with a remarkably fine-grained substance which was not doubly refractive. Only at the strongest magnifications could it be seen that very small units were present filling the entire field of vision uniformly. According to their form these deposits can be recognized as globulites. And not too infrequently series of such forms similar to margarite were observed.

In the great majority of cases the melts I and II showed the opacifying substance in a state of fine subdivision; but differences in the density and size of the globulites could be recognized.

The batches III with their very long period of temperature treatment showed the precipitated substance, just as did sections of I and II but of a more easily observable size and, as is described later, of another crystal habit.

The finest opacity occurred in those melts which became opaque at once on chilling and thus received no additional thermal treatment.

We are considering sections of melts II-4, 8, 13, 14, 15, 18, 19, 20, 21 and 23. Those of 18, 19 and 20 showed the presence of foreign bodies in the homogeneous mass only very indistinctly even at the strongest magnifications, in spite of the fact that the melts seemed thoroughly opaque to the naked eye.

To a certain extent zones of different degrees of opacity could be distinguished which crossed the section in the form of bands; in these cases it could be noticed that in the more strongly opaque areas the globulites seem to have separated smaller in size and more closely packed.

Section I-4 showed crystal skeletons of various sizes and density of deposition which were partially weakly doubly refractive due to internal stresses, a phenomenon which could be made to disappear by cooling. The growth of the crystal skeleton in this mass was induced by an additional heating for a long time.

Section II-5 showed a noteworthy size of deposit. On magnification 500 times the separated particles could be clearly recognized in some cases as cubes. These individuals were always appreciably larger than the surrounding globulites and were surrounded by a light field. The influence of the short heating to 800 degrees C. after the beginning of the opacifying action was unmistakable.

Section II-21 was very similar to that of I-10; it showed relatively large globulites and simple crystal structures surrounded by clear fields.

Section II-25 was filled with a maze of needle-like forms drusy at the neds. The separated crystal skeleton was isotropic; no specific orientation could be recognized and there were also lacking entirely the radially arranged crystal skeletons appearing in the other sections. The influence of two hours thermal after-treatment on the formation of the deposits was clearly shown.

Section II-26 was not uniformly opaque. The

*From Zeitschrift fur angewandte Chemie, May 12, 1927.

zones of equal intensity formed bands of uniform width. The more strongly opaque zones showed a coarse, dense mottling on weak magnification. The more weakly opaque areas of lighter color were filled with a tangle of separated crystal skeletons which were more strongly feathered and larger than those observed in section II-25.

The higher magnifications (above 500) showed the denser parts of the section as a mass of individual particles of varying size. In the more strongly developed individuals rectangular or tetragonal sections could be observed, partly distorted or rounded. Unevenly distributed cubic forms lay amongst these surrounded by a light field. Amongst perfectly formed cubes were also to be seen those of a distorted habit and cubes arranged in a series like a string of beads were also distinguishable. The spatial arrangement of the larger structures was entirely irregular.

The crystal skeletons separated out in the more weakly opaque zones were chiefly broad and heavily feathered. The projecting sections of individual parts of the skeleton showed tetragonal to rectangular cross-sections which were generally curved inward.

Section III-1a was filled with numerous crystal skeletons of varying size and structural form. To a certain extent there was an orientated arrangement of skeletons in long chains. On stronger magnification the principal part of the deposits was recognizable as a large mass of tiny particles which could be partially recognized as cubes. The cross-sections of the projecting portions of the crystal skeletons had a rectangular or tetragonal form and were generally curved concavely.

Section III-1b showed a mass of cubes and crystal sekeletons. Irregularly distributed in this were very small, chiefly rectangular doubly refractive plates. The habit of the crystal skeleton was fairly uniform. The projecting parts of the skeletons showed rectangular to tetragonal, chiefly concave sections. The double refractive plates showed light gray polarization colors and extinction exactly at the principal zone; the nature of the principal zone was positive and apparently biaxial. The optical character of the mineral was positive.

Section III-2 was filled with needle shaped extensively feathered crystal skeletons. In places these passed over to small cubes and coarse mottling. Very small doubly refractive rectangular plates were irregularly distributed throughout the

TABLE I

Conditions of Preparation of Melts I and II

| | Melts | Time of Fusion Minutes | Melting Point Degrees C. | Type of Crucible | Appearance After Chilling | Temperature of Initial Opacity on Reheating Degrees C. |
|---|---|---|---|---|---|---|
| I | 1 | 65 | 1130 | Platinum | Opaque | ... |
| | 2 | 60 | 1140 | Platinum | Clear | 675 |
| | 3 | 70 | 1110 | Platinum | Clear | Indefinite |
| | 4 | 60 | 1130 | Platinum | Clear | 650 |
| | 4a | 60 | 1130 | Platinum | Clear | 635 |
| | 5 | 55 | 1130 | Platinum | Clear | Indefinite |
| | 6 | 45 | 1130 | Platinum | Clear | Indefinite |
| | 7 | 60 | 1130 | Platinum | Clear | 585 |
| | 8 | 75 | 1130 | Platinum | Opaque | ... |
| | 9 | 45 | 1130 | Platinum | Clear | Indefinite |
| | 10 | 60 | 1080 | Platinum | Clear | 555 |
| | 12 | 60 | 1065 | Platinum | Clear | 555 |
| II | 1 | 60 | 990 | Platinum | Opaque | ... |
| | 2 | 60 | 980 | Platinum | Opaque | ... |
| | 3 | 60 | 1010 | Platinum | Clear | 565 |
| | 4 | 60 | 1030 | Porcelain | Opaque | ... |
| | 5 | 60 | 990 | Porcelain | Clear | 755 |
| | 6 | 60 | 990 | Platinum | Clear | 640 |
| | 7 | 60 | 1000 | Porcelain | Clear | Indefinite |
| | 8 | 60 | 1010 | Platinum | Opaque | ... |
| | 9 | 60 | 1010 | Porcelain | Clear | 645 |
| | 10 | 60 | 1000 | Platinum | Clear | 530 |
| | 11 | 75 | 1020 | Porcelain | Clear | 770 |
| | 12 | 60 | 1030 | Porcelain | Clear | 675 |
| | 13 | 60 | 995 | Porcelain | Opaque | ... |
| | 14 | 45 | 980 | Porcelain | Opaque | ... |
| | 15 | 105 | 980 | Platinum | Opaque | ... |
| | 16 | 40 | 980 | Porcelain | Clear | 580 |
| | 17 | 60 | 1010 | Platinum | Clear | 610 |
| | 18 | 70 | 980 | Porcelain | Opaque | ... |
| | 19 | 45 | 1010 | Platinum | Opaque | ... |
| | 20 | 75 | 1000 | Porcelain | Opaque | ... |
| | 21 | 45 | 1020 | Porcelain | Clear | 630 |
| | 22 | 75 | 1010 | Porcelain | Clear | 590 |
| | 23 | 60 | 1010 | Platinum | Opaque | ... |
| | 24 | 55 | 1010 | Porcelain | Clear | 560 |
| | 25 | 60 | 990 | Platinum | Clear | 575 |
| | 26 | 60 | 990 | Porcelain | Clear | 510 |

glassy mass. The edges were mostly strongly curved concavely and showed distinct extinction phenomena. They lay in light fields free from crystal skeletons. The plates were partially overgrown with small skeletons at the edges. The optical properties of the crystal plates agreed with those described for section III-1b.

The density of opacity varied in bands in which the maximum presence of crystal skeletons corresponded to the weakest opacity.

Section III-3. The precipitated substance was crystallized chiefly as cubes. Imbedded amongst them were a few simply branched crystal skeletons. The cubes were partially arranged in long strings.

Section III-4 was permeated by large crystal skeletons and cubes. The cubes which had deposited were well formed. Frequently concave edges were observed. The crystal skeleton appeared as a long string with rectangular or tetragonal cross section.

Section III-5 was very irregularly opaque. Together with narrow bands without any distinguishing feature there were others filled with a dense mass of crystal skeletons and doubly refractive small crystal plates. The crystal skeleton consisted chiefly of short, heavily feathered deposits and to a lesser extent of narrow bands which were druse-shaped at the ends. The crystal plates corresponded in their optical behavior with those of Section III-1b.

Section III-6 was uniformly opaque. The opacity had separated out in indistinct zones as a coarse corpuscular mottling and in other zones as crystal skeletons of the most varied size.

The coarse mottling appeared throughout as a deposit of cubes which were generally perfectly formed; only a few distorted forms could be found. The crystal skeletons in general had a radial structure with very delicate feathering. The projecting parts of the skeletons had in some cases a rectangular but more often a tetragonal cross-section the sides of which were curved only faintly concavely.

Section III-7 consisted almost exclusively of doubly refractive crystal plates. The isotropic glass basic mass was present to a vanishingly small extent.

There was a mass of narrow slit-like sections. They showed partially a fluid structure and partially a polysynthetic twinned lamination, both parallel to the principal zone. All the plates also showed banding running through parallel to the direction of greatest length which on stronger magnification appeared as flat trough shaped depressions. The extinction planes for the principal axis varied between 51 degrees and perpendicular extinction. The twinned structures extinguished in one group perpendicularly, in the other obliquely. The polarization color was pale straw yellow, the character of the principal section positive and biaxial; the character of the mineral was positive.

Section III-8 consisted chiefly of doubly refractive crystalline material but the vitreous mother substance was somewhat more strongly present than in III-7. The microscopic structure was chiefly of leaflets and two sections were cut parallel to and perpendicular to the leaflets. Together with large irregularly bounded plates there were polysynthetic twinned aggregates and spheroliths. The glass mass had shrunk to small volume between the crystals.

All the crystals in the principal section, which was difficulty recognizable, were delicately striped, the extinction was parallel to the principal plane and the polarization color was iron gray. The optical character of the principal plane was positive. The biaxial mineral was positive.

In and between the crystals there was irregular inclusions of the glassy mother substances chiefly in dendritic form.

Section 111-10 was filled with a heavy precipitate of cubes. Together with this there were large crystal skeletons. The arrangement of numerous cubes in strings was relatively common.

Section 111-11 was uniformly filled with cubes and short strings. Distinct crystal skeletons were not present. In a region where short rods with tetragonal cross-sections predominated in an area of 3 mm square the precipitated particles were arranged in two strings at right angles to each other. The faces of the cubes, etc. showed no concave distortion.

The refractive indices of the glassy mother substance and of the precipitated substances were determined by the immersion method with the aid of the Becke line. The refractive index of the glassy mother substance in all melts lay between 1.502 and 1.523. The refractive index of the precipitated crystal skeletons and cubes lay for most of the melts between 1.334 and 1.36. In melts II-25,-26 and III-5 there appeared crystal skeletons with refractive index between 1.40 and 1.44. In II-25 and -26 these precipitates were in the majority while in III-5 the majority had a refractive index of 1.334 to 1.36. The refractive index of the small separated crystalline plates lay between 1.502 and 1.54. The doubly refractive substance of section III-7 had a refractive index of 1.401 to 1.502, that of III-8 one between 1.502 and 1.523.

A separation and chemical analysis of the precipitated crystal skeletons and cubes was hardly possible on account of their small size. However, it could be determined that these substances were attacked by dilute acids and even by water, and in the case of the skeletons with refractive index 1.334 to 1.40 this occurred relatively easily and could be followed under the microscope. Reagents seemed to act noticeably more slowly on the substance of refractive index 1.404 to 1.446 in sections II-25,-26 and III-5; and water had no solvent effect on these.

The carrying out of extensive micro-reactions was prevented by the small size of the particles and difficulty of exposing them from the glass mother substances. For the same reason a more accurate determination of the refractive index than that given could not be made.

As opacifying agents for the glasses we need consider of the precipitates from the melts only the skeletons and cubes or globulites. All these precipitates were optically isotropic and exhibited even in the most strongly developed skeletons principally cubic faces. There were also to be seen individual octahedral surfaces.

All the opacifying substances belonged to the regular system. Their refractive indices were, with the exception of the melts containing calcium fluoride, equal and smaller than that for the glass mother substance in which they were imbedded. In the attempt to identify these opacifying substances all substances not crystallizing in the regular system could be excluded. Thus there was particularly ruled out of consideration minerals of the cryolith series, alumina, aluminum fluoride, etc. On the other hand the possibility of identity of the crystals with the fluoride introduced was considered in which case sodium fluoride was most often used.

Sodium fluoride crystallizes in the regular system; cubic forms occur principally and under special conditions also ochtahedral forms. The powdered product obtained from E. Merck showed insofar as they were retained cubic surfaces, and the refractive index of sodium fluoride is 1.334.

Calcium fluoride crystallizes in the regular system as fluorspar, principally (100) but occasionally also (110) and (111). In combinations numerous other surfaces may be present. Also the presence of crystal chains has been observed composed of cubes and showing ochtahedra at the ends.[14] The refractive index of fluorspar is 1.435.

Aluminum fluoride crystallizes in the hexagonal system. The refractive index is greater than 1.406 and less than 1.446.

The glasses containing sodium fluoride showed very extensive similarity in the structure of the small bodies precipited in them, in their refractive indices and in the nature of the crystal skeleton as observed under high magnification.

The glasses containing calcium fluoride are similar to those containing sodium fluoride in certain respects, but they were distinctly characterized—and in this respect they differed markedly in their structure from the fusions opacified by sodium fluoride—by the elongated pattern of the crystal skeleton felted at the ends. These glasses also showed the largest number of octahedral surfaces. The refractive index of these forms, lying between 1.404 and 1.446 corresponded to that of fluorspar, 1.435.

The batches opacified with aluminum fluoride had a structure for its opacifying agent which was identical in form and refractive index with the sodium fluoride melts. The precipitation of aluminum fluoride is thus hardly probable. It seemed more probable on the basis of these investigations that in the melts containing additions of sodium fluoride and aluminum fluoride the opacity was induced by the precipitation of sodium fluoride crystals

The glasses opacified with calcium fluoride contained, as shown above, besides the crystals and globulites identified as sodium fluoride, other deposits whose habit and refractive index pointed to calcium fluoride. In this case too, confirmation was obtained by the X-ray investigation.

The question now had to be considered whether the opacifier remained undissolved in the melt to begin with or first dissolved in the solution and precipitated only on subsequent cooling. That the latter assumption is the correct one is evidenced by the fact that completely transparent, water-clear melts can be prepared in which opacity can be induced by reheating. But even in those melts of Series I and II, which became opaque at once on cooling, the liquid melt was clear, and generally the glass cake obtained by rapid pouring on silver remained clear for a moment and the opacity proceeded from the edges as the cooling process advanced. We are thus dealing with substances crystallized out just before the solidification of the glass which is confirmed by the structure of the crystal individuals insofar as they can be observed.

The appearance of the crystal skeletons, which are recognizable, owing to the fact that the space is incompletely filled, indicates a rapid crystallization. Crystal skeletons of quite similar appearance can often be observed in glasses, as for instance in the separation of phosphates in melts with phosphatic additions.[15]

The formation of skeletal-forms may be explained by the fact that growth in certain directions from a focus is favored as compared to others and that these favorable directions are along the lines uniting the focus of the crystal to the edges and summits.

Lehmann[16] explains this observation by showing how the edges and summits of a crystal control a greater section of the diffusion stream than an equally large surface area of the growing crystal. The diffusion stream results from the formation of a zone of depleted solvent about the growing crystal; orientated diffusion towards the field sets in to restore equilibrium so that new material for deposition is brought to the crystal. Only in the case of slow crystal growth from a slightly supersaturated solution is a uniform deposition and uniform structure to be expected. In such a case there is a limited field of crystallization and correspondingly a weak diffusion of the substance separating out. In the inverse case we must assume a relatively high super-saturation in combination with rapid growth. A more exact examination of the larger

crystal skeletons showed that small crystals were attached to the individual branches. It was clearly recognizable in many cases that the skeletons were built up of many cubes.

A special form of precipitation was observed in several melts in which the opacifying material was crystallized in cubes which for the most part had no regular arrangement amongst themselves. This appearance of the cubes was recognized for the first time in Section II-26. This melt was after-heated for five hours at 600 degrees C. after the appearance of opacity. In the melts designated as III cubes appeared throughout. These were the glasses which had been subjected to a long thermal treatment. The particles of opacifying agent in this manner had an opportunity to grow slowly and uniformly.

An observation generally made in these sections was that the opacity had partially separated into zones of different crystal habit. Thus there were adjacent zones, one thickly permeated with cubes or even crystal skeletons alongside of one filled with crystal skeletons. In some cases their zones could be distinguished by the naked eye as the former corresponded to greater and the latter to weaker opacity. This phenomenon indicated concentration differences within the melts.

To judge from the behavior of the opacifying agent on precipitation it might be concluded that its solubility in the melt increases rapidly with rising temperature, but in discussing this question other phenomena must be taken into account which play an important part in this case.

The degree of supercooling plays an important part in determining the crystal habit. Nacken[17], in observing the crystal growth of salol in the neighborhood of its melting point noticed that for very small degrees of supercooling the crystals separate as spheres and if the temperature remains constant they continue to grow in this form. If the degree of undercooling was increased, the velocity of crystallization increased, and normal crystal planes formed on the sphere. In the case of stronger undercooling on the other hand long filamentous aggregates predominated the long dimension of which corresponded to the direction of maximum velocity of crystal growth. It follows from this that at temperatures a little below the melting point the vectors of velocity of crystallization are equal, while for stronger undercooling the vector with the largest numerical value enters predominantly into the foreground.

The production of devitrification must result from the glass being heated to temperatures at which centers of crystallization form and the velocity of crystallization assumes large enough values. As the latter assumes its maximum value at higher temperatures above that of spontaneous crystallization, the glass, in order to obtain the maximum possible devitrification, must be first kept at the temperature of spontaneous crystallization and then must be retreated at the temperature of maximum velocity of crystallization, i. e. it must be "developed."

It is to be noted that according to Tammann the velocity with which a glass is heated to initial devitrification is without appreciable influence on the temperature of initial crystallization.

It was obvious, as in other devitrification phenomena, to determine the initial devitrification by measuring the rise in temperature caused by the liberation of the latent heat of crystallization. This temperature rise may be noticeable—several hundred degrees—if the velocity of crystallization is large enough; it is proportional to the latent heat of crystallization and inversely proportional to the specific heat of the crystals formed. The application of this method was not possible in the case of the melts under consideration as the small fraction of the total which actually crystallized could not produce a sufficiently large thermal effect.

The velocity of crystallization of the substances which precipitates out was fairly large. It need only be mentioned that large crystal skeletons were formed by simple heating of the solidified glass to the devitrification temperature without any subsequent treatment to produce further development. Similarly the spontaneous crystallizing power was relatively large.

The influence of the alumina content of the melts on the form in which the opacifying agent separated was quite obvious; it was noted that the size of the individual opacifying particles decreased as the alumina content increased. In series II the particles separating in the alumina-free melts were in all cases appreciably larger than for those containing alumina and subjected to the same treatment. This was particularly evident in the case of glasses II-24 and -25 containing calcium fluoride. Under identical conditions of thermal treatment the first showed globulites exclusively while the second alumina-free melt but otherwise of analogous composition was filled with crystal skeletons of considerable size.

The influence of the thermal treatment may be recognized by the fact that the structure of the opacifying medium approaches that of the normal crystal more closely the longer the melt is kept with the devitrification interval. This was particularly noticeable in the formation of crystal skeletons in the melts of identical composition but different thermal treatment.

Melts I-4, II-1,-2 and III-1a had the same original composition. Melt I-4 prepared at 1130 degrees C. solidified to a clear mass and began to become opaque at 650 degrees C. The opacifying agent separated chiefly in the form of coarse globulites and very small crystal skeletons. Glasses II-1 and -2 melted at lower temperatures solidified at once in the opaque state.

# INTIMATE NEWS OF MEN AND PLANTS

## Port Crescent Will Change Grading Process

Changes in the fluming process of grading sand will be made by the Port Crescent Sand and Fuel Company at a cost of several thousand dollars. This company operates a plant at Port Crescent, Michigan, producing an excellent grade of moulding sand.

## Lake Sand in New Quarters

The Lake Sand Corporation has moved into its new quarters in the Builders Building, 228 North La Salle street, Chicago.

## Cooper Crushed Stone Increases Capital

At a recent meeting of the stockholders and directors of the Cooper Crushed Stone Company, Inc., it was unanimously decided to increase the capital stock from $50,000 to $100,000 to meet the increasing demand for the product which they manufacture. This additional money will be used for the enlargement and development of their plant at West Nanticoke, Pennsylvania.

A general report made a very creditable showing at the end of the first six months in business and due to the ever increasing demand for crushed stone and sand for the next few years the company felt that they would be justified in making numerous changes and enlargements. The company consists entirely of local men, and it is headed by prominent Plymouth business men.

## Brownell Purchases Property

The Brownell Improvement Company, manufacturers of crushed stone used in building, has enlarged its facilities by the purchase from the Chicago Title and Trust Company, as trustee, of a block of ground between Seventy-fifth and Seventy-sixth streets and Claremont and Oakley avenues. This property, now vacant, is to be used as a material yard. A small office building is the improvement contemplated. The company has a yard at West Ninety-fifth street and Eggleston avenue.

## Two Dayton Firms Merge

The Morain Asphalt Sand Corporation of Dayton, Ohio, has been merged with the Wolf Creek Gravel and Sand Company of the same city.

## Buys Granite Company

Clyde Bryan has purchased the Graham and Crist memorial stone manufacturing plant located at Salem Ohio, but sold out his interest three years ago and he is now purchasing them back again.

## New Stone Company

The Great Northern Stone Company was recently incorporated in Cleveland for $500,000 to take over the quarry properties at Sandusky formerly operated by the Lake Shore Products Company. The incorporators were Oscar J. Horn, J. H. Cassell and C. E. Wielsel. This information sets at rest many rumors which had spread in this vicinity due to the purchase of certain lands at better than average prices.

## Island Sold to Sand Company

Eight mile Island, said to contain the largest deposit and the best quality of sand to be found anywhere in the Ohio River has been sold to the Westers Rivers Sand Company of Point Pleasant, Ohio. The island is about forty-three acres in extent.

## Secures Big Marble Contract

The Beaver Dam Marble Company of Baltimore, Maryland, operating quarries at Cockeysville, Maryland, has secured the contract for furnishing the exterior marble to be used in the new Fisher building at Detroit, Michigan. The first unit of the building, it is said, will require the delivery of over a million dollars worth of marble within the next six months.

## New McGrath Plant

The McGrath Sand and Gravel Company are building a new sand and gravel washing plant on its property at Forreston, Illinois, which it is estimated will cost in the neighborhood of $60,000. The new plant will not only include a new rotary washing plant but will also include five concrete storage bins which will have a combined capacity of about twenty cars.

## Niagara Stone Products Sold

The Standard Asphalt Company of Cleveland, Ohio, has purchased from Hamilton Brothers, attorneys, the plant of the Niagara Stone Products Company of Bellefontaine, Ohio. The new owners will immediately expend $85,000 for new stone crushing equipment and an asphalt plant.

## Universal Boat Sets Record

Setting a new high mark in fresh water shipping annals, the "Carl D. Bradley," biggest Great Lakes steamer afloat, eased in to the new Buffington (Indiana) Harbor last month with 15,724 tons of limestone, said to be the largest load ever carried on fresh water. Her own automatic unloading machinery discharged the cargo in five hours which is believed to break all records for speed. The limestone came from the Calcite, Mich., quarries, the largest in the world.

This huge new vessel is the latest example of the modern self-unloading type of freighter. Buffington Harbor at the Chicago plant of the Universal Cement company is one of the few harbors on the Great Lakes deep enough to accommodate so large a boat. A million-ton storage yard provides ample space for raw materials brought in by water and permits the cement company to store materials against close of navigation thus promoting uninterrupted production.

## Dolomite Buys

The Dolomite Products Company of Cleveland, Ohio, have purchased the common stock of the Leatham D. Smith Company, operators of a large limestone quarry at the mouth of Sturgeon Bay, Wisconsin. According to H. P. Eells, president, the quarry acquired will be operated from Cleveland and it is expected that the present annual plant capacity of 450,000 tons, will be doubled.

## New Cement Plant

The Mathieson Alkali Works, Inc., are designing a new 1,000,000 barrel capacity cement plant to be located at Saltville, Virginia.

## Bruns Hydrated Lime Reorganized

R. E. Kaemming of Woodville, Ohio, has become president of the Bruns Hydrated Lime Company in the place of C. R. Bruns, resigned. D. C. Robinson, mayor of Woodville, has been elected to the board of directors and W. M. O'Connor has been made plant superintendent. The plant is now in production.

The main office of the Consolidated Cement Corporation is being moved from Cement City, Michigan, to Jackson, Michigan.

## New Incorporations

Ellett Lime Co., G. R. Hash, 408 Day Ave., Roanoke, Va. $25,000. Paul G. Hash, M. J. Patsel, 379 Allison Ave.

General Mica Co., F. Bailey, Penland, N. C. W. P. Deneen, Micaville; F. A. Swift, Spruce Pine.

F-A-C Crushed Rock Corp., Mission Valley, San Diego, Calif. $40,000. S. W. French, A. Anderson, J. A. Corriere.

Raleigh Sand & Gravel Co., 2738 Broad St., Memphis, Tenn. $100,000. J. L. Powell, Mgr.

Maloy-Riggs Sand & Gravel Co., 167 Green St., Albany, N. Y. $20,000. James H. Maloy, Pres. and Sec.; Dennie B. Riggs, V.-P. and Treas.

Tidewater Gypsum Co., Houston, Tex. Howard Kenyon, 4520 Carolina St.; J. E. Browne, West Bldg.; Austin Y. Bryan, Jr.

Cement Sand & Gravel Co., Duluth, Minn. $50,000. Hugh J. McClearn, Pres.; C. L. Larsen, V.-P.; Leslie C. Gilbertson, Sec.-Treas.

Arkansas Asphalt Co., Little Rock, Ark. $1,600. G. B. Rose, W. W. Dickinson, Moorhead Wright.

St. Helens Sand & Gravel Co., Shively, Ky. $15,000. William B. Thomas, A. J. Huber, Carl Less.

El Paso Rock & Gravel Co., Sacramento, Calif. $500,000. L. M. Roberts, M. M. Albee.

Indianapolis Sand & Gravel Co., Indianapolis, Ind. $15,000. C. O. Dodson, Minnie T. Dodson, Otha F. Calvin, Eliza J. Calvin.

Great Northern Stone Co., Sandusky, O. $500,000. Taking over quarry properties formerly operated by Lake Shore Products Co.

Osage Gravel Co., Indianapolis, Ind. C. B. Kessinger, R. R. 4, Vincennes, Ind., agent.

Marble & Limestone Development Co., Pueblo, Colo. $50,000. T. H. Devine, John H. Thatcher, C. H. G. Johnson.

H. G. Swendsen & Co., Seattle, Wash. $25,000. Sand and gravel. H. G. Swendsen, W. C. Richards.

Perkins Sand & Gravel Co., Calvert, Tex. Jess and Jack F. Perkins, Bryan Adams.

Plastic Lime Process Co., Knoxville, Tenn. Wm. K. Hunter, M. F. Nichols.

Pittsburgh White Sand Co., Philadelphia, Pa. $5,000. G. S. Smith, Gwynedd Valley.

Schumacher-Behrendt Sand & Gravel Co., Utica, Mich. $25,000.

Hernado Crushed Stone Co., Brooksville, Fla. J. J. DeGunther, D. B. Gore, J. C. Flisch.

Crowe Lime & Cement Co., Amarillo, Tex. $30,000. E. L. Roberts, U. N. Oliver, C. T. Crowe.

Agricultural Lime & Trap Rock Corp., Wilmington, Del. $700,000.

Sturgeon Bay Co., Wilmington, Del. $500,000. Limestone. (Corp. Trust Co. of America, Wilmington.)

Wamego Sand Co., Wamega, Kans.

## Halleck and Hill Elect

At the board of directors meeting of the Halleck & Hill Gravel Company, Inc., held Saturday, October 8, 1927, the following officers and board of directors were elected. The officers are L. T. Berthe, Charleston, Missouri, president; C. M. West, Bowling Green, Ohio, vice-president; R. M. Strowl, Bowling Green, Ohio, treasurer; G. G. Hill, Bloomfield, Missouri, secretary and general manager. The board of directors consists of L. T. Berthe, C. M. West, R. M. Strohl, G. G. Hill and T. J. Stoole, Jr.

## Westinghouse Men Promoted

Mr. J. S. Tritle, general manager of the merchandising department, has just announced the consolidation of several merchandising territories and the appointment of executives to be in direct charge of operations in these sections. Mr. M. C. Morrow has been appointed sales manager of the merchandising department. Mr. F. R. Kohnstamm has been appointed assistant sales manager of the merchandising department.

The territory comprising the northeastern sales section and the Philadelphia district has been consolidated with respect to merchandising and will be known as the Northeastern Merchandising District. Mr. George T. Kunklin is appointed district merchandising distribution manager of this territory with headquarters in New York.

Mr. George Bailey, who has been assistant to general manager of the merchandising department, is appointed district merchandising distribution manager at San Francisco of the territory comprising the present San Francisco, Los Angeles, and Seattle districts which have been consolidated with respect to merchandising and will be known as the Pacific Coast Merchandising District.

Mr. P. Y. Danley, formerly manager of the interior lighting section, is appointed district merchandising distribution manager of the territory comprising the present Pittsburgh, Cincinnati and Detroit districts. These are consolidated with respect to merchandising and will be known as the North Central Merchandising District. Mr. Danley's headquarters will be at Mansfield, Ohio. Mr. J. Paul Teller is appointed manager of the interior lighting section and will continue to be located at South Bend, Indiana.

## To Sell Highway Material to South America

The Pan American Industrial Corporation has been organized under the laws of Delaware to engage in the business of supplying highway building material to the principal countries of South America. The company's first business will be the supplying of stone to the Argentine Republic, where over $150,000,000 has been appropriated for highway construction. A South American company, the Compania Americana de Construcciones and Pavimentos, has been acquired for use in developing the work.

The president of this company is Joaquin S. de Anchorena, twice mayor of Buenos Ayres and a director of the German General Electric, the General Company of Public Works, the largest construction company in South America, and the Argentine Portland Cement Company, a subsidiary of the International Cement Company of New York.

## Casparis Ohio Quarries Sold

Albert H. Morrill, Cincinnati, purchased the properties of the Casparis Ohio Quarries Company at a receiver's sale for $23,000. The properties are located at Melvin, Indiana, and Greenfield, Ohio.

## Clay Imports and Exports

The imports and exports of clay increased in quantity and value in 1926 as compared with 1925. The imports of clay amounted to 489,670 short tons, valued at $4,247,911, an increase of 12 per cent in quantity and 11 per cent in value. Exports of clay in 1926 amounted to 89,894 tons, valued at $992,718, an increase of 8 per cent in quantity and 13 per cent in value as compared with 1925. Kaolin, or china clay, constituted 81 per cent of the total imports in 1926. Fire clay, the principal clay exported, amounted to 53 per cent of the total.

Clay sold by producers in the United States in 1925 and 1926:

| | 1925 | | 1926 | |
|---|---|---|---|---|
| Kind | Short tons | Value | Short tons | Value |
| Kaolin | 367,319 | $ 3,220,719 | 432,215 | $ 3,771,568 |
| Ball clay | 109,607 | 699,427 | 112,195 | 867,500 |
| Slip clay | 7,349 | 37,397 | 8,644 | 45,959 |
| Fire clay | 2,566,934 | 7,312,349 | 2,815,961 | 8,111,239 |
| Stoneware clay | 77,438 | 162,161 | 82,476 | 182,236 |
| Miscellaneous | 901,773 | 1,304,579 | 514,822 | 1,124,003 |
| | 4,030,420 | 12,736,632 | 3,966,313 | 14,102,505 |

# NEWS OF EQUIPMENT MANUFACTURERS

## New Skip Conveyor

Jordan Machine Works are now in manufacture of a new conveying unit known as the Larner's Skip Conveyor. This machine is the invention of Herbert A. Larner, a quarryman of Staunton, Virginia, and is really a development that came in solving one of his own transportation problems. The conveyor is made in two units. One unit is the skip itself, weighing 500 pounds. The other unit is a conveyor rigging including all the apparatus for handling the skip. The machine is adapted to fit a 1½ ton International motor truck and is entirely operated by one man.

The illustration shows the shovel loading the skip on the ground. The skip is attached to the truck in a few moments. Clamps are used at the end of the apparatus next to the driver's seat and the conveyor is bolted at the end of the chassis. Mounted upon the crossbeam immediately over the skip is a pulley and at the junction of sidebeams with the crossbeam are two more such pulleys. Chains pass from the winding drums over these pulleys and hang downward. The side chains are formed with a ring at the lower end while at the end of the third chain is a hook. The side chains engage studs at such a distance from the rear wall of the skip that when loaded the skip has a tendency to depress at the rear, thereby preventing over-balance and slippage at the mouth of the skip.

The truck is backed into position and the chains engaged. By means of a crank with an unusually long handle, the skip is lifted off the ground. The skip can be lifted to any desirable height up to the top of the rigging. The crank arm swings back to a vertical position and so remains while the truck is moving from the loading point to the point of discharge.

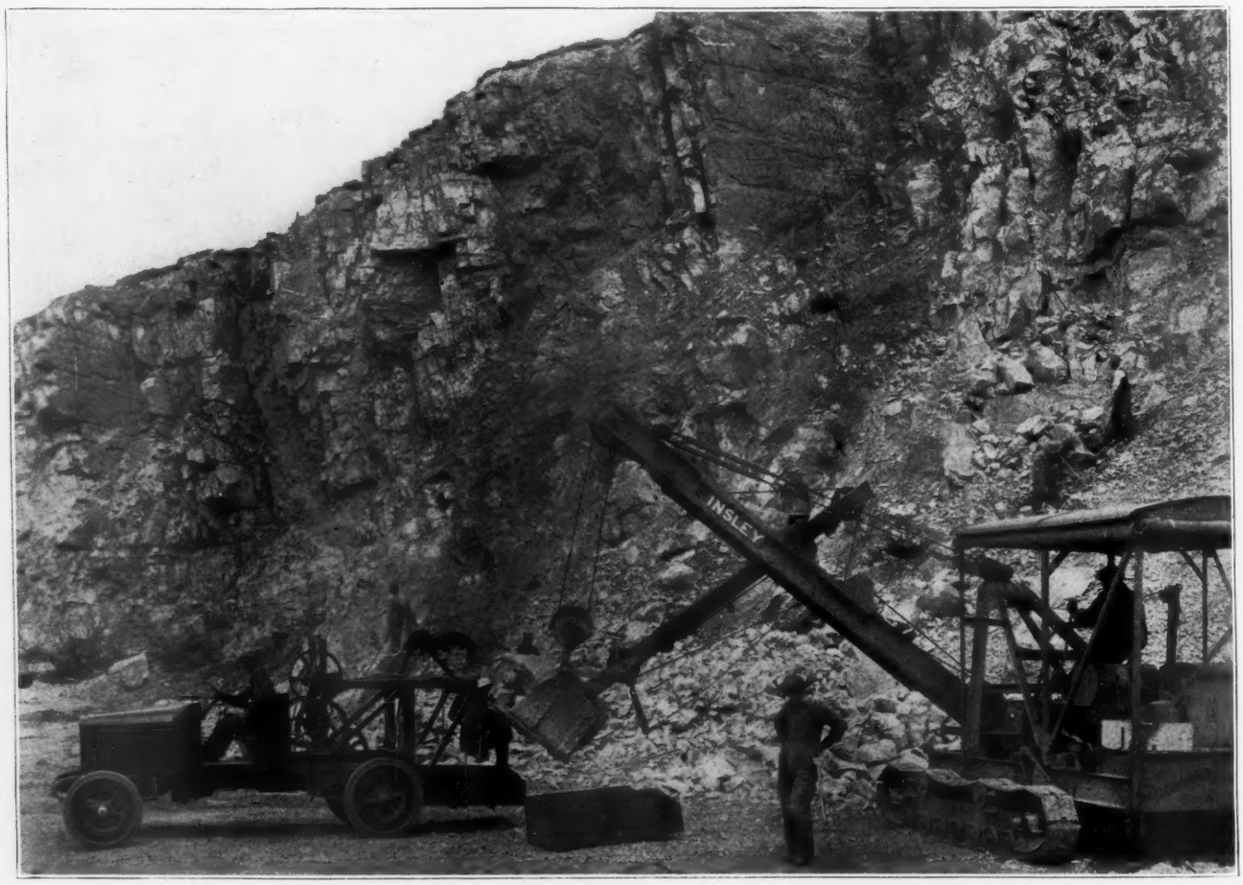
In discharging, the long crank arm engages a tripping member tilting the rear end of the skip and automatically dumping the stone. When a skip has been discharged the weight of the crank handle, which has shifted the extremity of the tripping member of the apparatus, causes the winding drum to rotate in a reverse direction, lowering the rear end of the skip until it is in its horizontal position.

When the truck is ready to release its skip for reloading a pawl is released and the winding drums are reversely rotated to release all three of the chains supporting the skip so that the skip is lowered to the ground. The chains are then disengaged from the empty skip and the truck is moved to the position for picking up another loaded skip.

The entire operation of this unit is a one man affair. Its speed and flexibility are greatly in its favor. The elimination of both considerable labor and other equipment which it replaces are important factors in the adaption of this machine to loading and transporting material in pit or quarry. The machine is also excellently adapted for loading and removing stripping.

## New Miami Distributor

The G. & G. Equipment Company of 47 West Seven Mile Road, Detroit, Michigan, have been appointed distributors in the Michigan Territory for The Miami Trailer Scraper Company. Miami scrapers and back fillers for use with the Fordson Tractor will be carried in stock.




Larner Skip Conveyor Ready with One Skip Load While a Shovel Loads Another Skip

## New Jeffrey Scraper

Drag-On is the name of the latest Jeffrey Portable Scraper Conveyor for handling coal and coke in retail coal yards, power plants, and industrial plants. Its principal points of difference from previous models of Jeffrey portable scrapers are the reduced weight of the frame, the increased size and strength of the conveying chain and the larger screening chute.

The new twenty-five foot Jeffrey Drag-On is eleven hundred pounds lighter than its predecessors. This lessened weight, which makes the Drag-On easy to move around, is gained by lightening the frame and shortening the mast. Although the frame is lighter, the working and wearing parts of the Drag-On are actually stronger. The conveying chain for example, is the combination type Jeffrey 188 Hercules. The flights of quarter-inch steel plates are L shaped and run the full width of the trough. The bottom plates of the loading end of the trough are also of quarter-inch steel; these plates have been made extra heavy to stand the pounding of the coal in the loading pit.

The screening chute is three feet long and gives six square feet of mesh for taking the fines out of the coal while loading. This mesh is welded from round bars arranged so that the coal meets no resistance in sliding over it.

New wheels on the Drag-On also help to increase its mobility. These wheels are four feet in diameter, on three inch tires, swiveled to turn in either direction. The Drag-On will therefore describe a complete circle around a fixed loading point. The wheels are bronze bushed and pressure greased. Power for the Drag-On is supplied by an electric motor running on either ball or roller bearings as desired.

For raising or lowering the discharge end of the Drag-On, an easily handled worm-geared winch pulls a cable over the top of a short, rigid mast. This winch is high pressure lubricated, as is every other transmission part.

## A. E. C. Appoints Drake

The American Engineering Company announces the appointment of Mr. George L. Drake as agency sales supervisor for its Lo-Hed hoist division.

## New R. W. Hunt Office

The Robert W. Hunt Company announce the new location of their Birmingham office in the Bankers Bond building.

New Jeffrey Scraper Conveyor

## New Model Cyclone Hoist

Described as an efficient, economical and long-lived light-weight high speed chain hoist, the new model K Cyclone hoist, manufactured by The Chisholm-Moore Mfg. Co., made its appearance recently. The new hoist is constructed on the same gyrating yoke principle that is to be found in the previous Cyclone model hoist manufactured by the same company. New engineering improvements, however, give the new hoist a working efficiency of 90 per cent as against 80 per cent for the previous Cyclone models and a length of life, without repairs, considerably longer than that of the old model.

In a series of rigidly conducted tests, the new model K Cyclone was operated continuously for a period of 320 hours. At the end of that period it was taken down and thoroughly inspected. It was found that no repair parts were needed and only slight wear was noted on the working parts. Considering that this test was the equivalent of lifting and lowering 38,400 one ton loads, the performance of the hoist becomes all the more remarkable.

Among the changes that made this record possible was the addition of anti-friction bearings at every rotating point. Altogether, eight ball bearings, four roller bearings and one Timken thrust roller bearing in the lower swivel hook help to increase the new hoist's efficiency.

One of the most important changes was made in the four eccentric roller bearings. In the old models the rollers in these bearings were loose and had to be carefully fitted into their cage at the time of assembling the hoist. In the new model K Cyclone these roller bearings are built in one complete unit which does away entirely with the loose rollers.

Another important improvement is the long-life lift wheel. Since this is usually one of the first places to show signs of wear, it was necessary to find the longest-lived material possible for this part of the new hoist in order that it would equal the prolonged length of life that the anti-friction bearings made possible. After considerable research in their own laboratories and foundry, The Chisholm-Moore Ffg. Co. developed a new steel alloy which was far harder than any other available material, gave exceptionally clean and accurate chain pockets, and, in the test referred to above, showed practically no sign of wear after 320 hours.

Another feature of the model K Cyclone is that all parts are strictly interchangeable. It is possible to assemble all parts into the hoist frame without regard to "right or left," "upside or down," center punch marks or other generally accepted means of matching parts. Together with the exceptionally long-life feature, this interchangeability promises to keep maintenance bills down to a minimum. As with the previous Cyclone model, the entire mechanism of the hoist is enclosed in a dust-proof, oil-tight frame. This feature makes possible a minimum of attention for the hoist needs to be packed with grease only once a year under ordinary usage.

Because of the logical distribution of material used in construction, the hoist is very light in weight, making it possible to carry the smaller models easily from one job to another. The exceptional efficiency, greatly increased length of life, and other features of this new C-M model K Cyclone hoist promise to make it one of the most popular on the market.

## New Automatic Welder

A new "Stable-Arc" carbon arc, automatic welding machine has been recently developed by The Lincoln Electric Company. The machine is designed for the purpose of welding the heads in small cylindrical tanks or boilers. The tank is mounted on a rotating table in an inclined position. The rotating table is driven by a small variable speed motor which provides speed adjustment for tanks of various diameters. Roller rests are provided which maintain the alignment of the work. The carbon electrode is carried by an adjustable arm supported from a rigid pedestal on which the motor starter is mounted. No filler metal is required in this operation; the head being flanged and inserted so that a lap joint is secured as in a riveted tank. The heat of the arc melts the edge of the lap weld of the cylindrical sheets, fusing it with the head and forming a solid, leak proof joint. On 14 gauge material, seams have been welded at the rate of 135 feet per hour.

While these machines were developed primarily for welding range boilers they are equally applicable for welding all kinds of small cylindrical tanks. The cost of making tanks by this method is considerably less than by manual arc welding and of course far less than for riveted construction.

This is one of three automatic machines used in making cylindrical tanks. The other two are the carbon-arc and the automatic welding machines for making the longitudinal seam and welding the bottom into tanks. With all three the entire tank can be made without any hand welding.

## Falk Expands in Canada

The Falk Corporation has made arrangements with William Kennedy and Sons Ltd. of Owen Sound, Ontario, to manufacture, under license, Falk gears, speed reducers and couplings. This will open up to Canadian industry methods of power transmission which the Falk Corporation has heretofer confined to the United States.

## Speeder Appoints

Edgar McNall, for eight years connected with the advertising departments of Cedar Rapids newspapers, has been appointed advertising manager of the Speeder Machinery Corporation, Cedar Rapids, Iowa.

Mr. McNail will have charge of the greatly enlarged advertising program the Speeder Corporation plans for 1928 and will render advertising assistance to Speeder distributors throughout the United States and Canada.

Robert W. Gillispie

## Robert W. Gillispie Promoted

Robert W. Gillispie was recently elected vice president and general manager of the Jeffrey Manufacturing Company of Columbus, Ohio. Mr. Jeffrey, who for years was connected with the Bethlehem Steel Company, joined the Jeffrey organization July 1, 1926, as vice president and assistant general manager.

## New Climax Official

Mr. G. W. Dulany, Jr., chairman of the board of the Dulany Trust, Chicago, has announced the election of Mr. E. B. Mallory as vice president and member of the board of directors of the Climax Engineering Company, a subsidiary of the Dulany Trust. Mr. Mallory began his career with the Westinghouse Companies in 1903, having been broadly trained in its various engineering, manufacturing and sales activities during his many years with the company.

He was manager of the radio department of the company during the phenomenal growth of that new branch of the electric industry, and brings to the engine industry a broad acquaintance among manufacturing and commercial interests, and a keen understanding of the problems of design, manufacture and exploitation of industrial apparatus.

Prominent as a leader in the organization of the radio industry, having served as association chairman for two years, and highly successful in organizing and coordinating the various departmental activities of manufacturing operations, his identity with the engine industry suggests the probability of association activities and interesting commercial consolidations.

## Chain Belt Buys Another

The mortar and plaster mixer business of the Atlas Engineering Company has been purchased by the Chain Belt Company. This is the second manufacturing business the company has bought within a year, the Stearns Conveyor Company, Cleveland, Ohio, manufacturers of belt conveyors, being taken over about eleven months ago. In buying the mixer business of the Atlas Engineering Company a complete line of mortar and plaster mixers will be added to the Rex line of concrete mixers. The Atlas Engineering Company was organized 16 years ago and during the past three years the company has made admirable progress in their business under the direction of H. W. Zimmermann.

The Chain Belt Company was organized in 1891 by C. W. Levalley as a chain business. Later engineering and conveying lines were added and in 1907 the manufacture of Rex concrete mixers was started. The Company operates two plants in addition to the one at Cleveland, one at Eleventh avenue and Park street, and the other at West Milwaukee where the engineering building, concrete mixer building, and malleable iron foundry are located. The engineering building was erected in January of this year and is the third major unit to be erected on the company's 59 acre tract. Branch offices are maintained in 16 principal cities.

Four other companies are affiliated with the Chain Belt Company—the Federal Malleable Company, Sivyer Steel Casting Company, Interstate Drop Forge Company of Milwaukee, and the Nugent Steel Casting Company of Chicago.

## F. W. Taylor Dies

Francis Winthrop Taylor, vice-president of the S. G. Taylor Chain Company, Chicago, passed away on Sunday morning. October the ninth, 1927. Those who were privileged to know Francis Taylor will never forget his loving personality, his genial disposition and his constant and generous nature.

## New Falk Representative

Mr. H. R. Harris, 1123 Metropolitan Life Building, Minneapolis, Minnesota, has just been appointed as representative of the Falk Corporation, manufacturers of herringbone gears, speed reducers and flexible couplings. Mr. Harris will cover the state of Minnesota and also Douglas County, Wisconsin.

## Weighing Hoppers Discussed

In Bulletin 150, recently issued, The Butler Bin Company illustrates and describes weighing hoppers of modern design. The measurement of aggregates by weight is demanded by many construction engineers because of the greater accuracy that is possible in proportioning the materials. The "bulking" of sands increases (up to a certain point) with the amount of moisture that it contains, but because the amount of bulking varies widely with different grades of sand, it is difficult to make proper allowance for moisture in the volume method of measurement.

In measuring by weight it is only necessary to ascertain — by simple field tests—the weight of water in the sand to make proper allowance so that the aggregates are proportioned on the basis of dry weight.

Butler weighing hoppers combine highly accurate measurement of aggregates with extreme simplicity of operation. They may be arranged to operate in three different ways:

1. Sand and coarse aggregate may be weighed separately in individual receiving hoppers, each suspended from its own scale. This is done in a type G hopper.

2. Both aggregates may be weighed separately in individual compartments of a receiving hopper suspended from a single scale. This is done in the type H hopper.

3. The sand may be weighed in a type G weighing hopper and the coarse aggregate measure by volume in a type C measuring hopper.

All of the three methods are highly accurate and the operation of the hoppers is so simple that it may be done by any ordinary laborer. The weight of the sand (dry) and the weight of the water in the sand may be quickly determined by a simple test. In weighing off any given batch, the weight of the water is added to the weight of dry sand desired so that each batch weighed off represents a definite value in dry sand.

The Butler weighing hopper consists of a steel receiving hopper suspended on a five point, hopper type, suspension scale with a control gate fastened to the underside of the storage bin and directly above the receiving hopper to control the flow of material into the receiving hopper. On the end of the horizontal extension lever (which is carried out to a point beyond the path of the conveying vehicle) is a verticle rod with pans for the removable weights. A steel tool box is provided in a convenient position to store these weights when not in use.

The scale is so constructed that all of the five suspension points are fastened to the gate frame. The horizontal extension lever is spliced so that in shipping, the gate, receiving hopper and scale can be shipped as an assembled unit by unbolting the extension lever at the splice point; thereby making the installation on the job very simple.

When desired these scales can be equipped with a dial which makes it possible to read any portion of the last three hundred pounds on the dial, the remainder of the weight being taken care of with the removable weights. This dial may be installed at any time at slight additional cost.

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## Foote Acquires Plamondon

With the purchase of the A. Plamondon Manufacturing Company, of Chicago, by Foote Brothers Gear and Machine Company, recently announced, is consummated a merging of two pioneer industrial firms, both with a history extending back into the early days of Chicago's industrial growth—both nationally known and highly regarded as manufacturers of gearing and power transmission equipment. The A. Plamondon Manufacturing Company is the older of the two firms—having been organized in 1859 by Ambrose Plamondon and carried on by the members of his family for nearly seventy years.

In 1896 Charles A. Plamondon, son of the founder, upon his fathers death succeeded to the presidency of the company and under his leadership it steadily grew in importance as a factor in Chicago's industrial progress. The Great War brought an added impetus to the business, but its tragedy was brought sharply home to the company by the untimely death of its president, as a passenger on the ill fated Lusitania, when it was torpedoed by the Germans, in May, 1915.

Shortly afterwards, the interests of the surviving brothers, George and Alfred D. Plamondon, were purchased by the remaining stockholders and J. T. Benedict, became the active head of the business in 1916. Mr. Benedict became associated with the Plamondon interests through his marriage to the daughter of Jeanette Plamondon and Dr. John B. Murphy, one of the world's most famous surgeons.

The merging of the lines of the two companies puts Foote Bros. in a position of being the largest gear and speed reducer manufacturer in the world and adds a complete line of transmission equipment that will greatly expand their field activities.

The present plant of the A. Plamondon Company, acquired by Foote Bros., comprises a modern machine shop, pattern shop and foundry, housed in a modern factory building 500 feet long by 125 feet wide. The personnel of the old organization will be retained and Foote Bros. will also be able to offer to their own customers a more complete service on transmission equipment through the additional lines acquired.

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## New G. E. Data

A new General Electric bulletin in loose leaf form for inclusion in catalog describes and illustrates single-stage centrifugal air compressors. The centrifugal compressor, or blower, was introduced in this country twenty years ago by the General Electric Company. It has been successfully applied to all classes of service where air is required, and for exhausting and boosting gas. Greater flexibility of operation, combined with lower total operating costs, including the items of power, maintenance, and fixed charges, has resulted in the standardization of centrifugal compressors for many industrial applications.

For the past three years, the General Electric Company has been conducting an intensive research program for the purpose of increasing the efficiency of the centrifugal compressor, with the result that seventy-five sizes have been redesigned with greatly improved efficiency. The machines are solidly built, and their operating records attest their reliability. All parts of the unit have been made accessible and proper lubrication of the bearings is assured by the oil pump which is supplied with all machines. This pump is driven from the main shaft of the unit.

The volume range of G-E compressors is 250 to 75,000 cu. ft. per min. The 250-cu. ft. unit can be built for pressures of from 1 to 4 pounds. Higher pressures are practical where the volume rating is higher; in general, the pressure range extends to 35 pounds gauge.

The listed motor-driven compressors operate at 3600 r.p.m. Where 25-cycle power only is available, G-E herringbone gears are employed to increase the speed. Turbine-driven units are furnished with speeds of 3000 to 8000 r.p.m.

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The Rollway Bearing Company, Inc. have opened a sales office at 956 Leader Building, Cleveland, Ohio. Mr. R. D. Faris has been appointed Cleveland district representative and will make his headquarters at this address.

**Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.**

| RATES PER INSERTION | 1 Inch | 2 Inches | 3 Inches | 4 Inches | 5 Inches | 6 Inches | 8 Inches | 9 Inches | 10 Inches | 12 Inches | 15 Inches | 20 Inches | 30 Inches |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Insertion | $3.75 | $7.25 | $10.75 | $14.25 | $17.75 | $21.25 | $28.25 | $31.75 | $35.25 | $42.25 | $56.25 | $70.25 | $105.00 |
| 2 Insertions | 3.75 | 7.25 | 10.70 | 14.20 | 17.65 | 21.15 | 28.15 | 31.65 | 35.15 | 42.15 | 56.15 | 70.00 | 104.00 |
| 3 Insertions | 3.75 | 7.20 | 10.65 | 14.15 | 17.55 | 21.05 | 28.05 | 31.55 | 35.10 | 42.05 | 56.05 | 69.75 | 103.00 |
| 4 Insertions | 3.70 | 7.15 | 10.60 | 14.10 | 17.45 | 20.95 | 27.95 | 31.45 | 35.00 | 41.95 | 55.90 | 68.75 | 101.00 |
| 8 Insertions | 3.65 | 7.05 | 10.50 | 14.00 | 17.25 | 20.75 | 27.75 | 31.25 | 34.80 | 41.75 | 55.70 | 67.50 | 98.00 |
| 13 Insertions | 3.60 | 6.95 | 10.40 | 13.90 | 17.05 | 20.55 | 27.55 | 31.05 | 34.60 | 41.55 | 55.55 | 66.25 | 94.00 |
| 26 Insertions | 3.50 | 6.75 | 10.20 | 13.70 | 16.65 | 20.05 | 27.05 | 30.65 | 34.20 | 41.05 | 55.05 | 64.00 | 88.00 |

INFORMATION—*"Broadcast"* space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width. The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

## It Pays to Advertise in PIT and QUARRY

The Ward Sand and Gravel Co., Oxford, Michigan, inserted a "wanted" advertisement for a sand pump in the August 31 issue, and under date of September 15, 1927, they wrote that: *"The results received from the advertisement were satisfactory."*

**Complete Service Publishing Company**

**538 South Clark Street** **CHICAGO**

## Machinery for Sale

SPECIALS
**Two No. 6 Williams Universal Hammer Mills.**
**Two 6' Hardinge Mills and One 4½' Hardinge Mill.**

### CRUSHERS

**Crushing Rolls**

One new 42"x16".
One 8"x5", two 16"x10", two 24"x12", one 30"x10".
Two 26"x15", one 30"x16", two 36"x16", one 54"x24".

**Gyratory**

All sizes from No. 2 Reduction to No. 12K.

**Jaw**

One 4"x8"—two 7"x10"—one 6"x20"—two 9"x15"—one 10"x20"—two 12"x24"—one 13"x30"—one 18"x36"—one 24"x36"—one 40"x42"—One 60"x84".

**Rotary**

**Two No. 0, two No. 1, one No. 1½, and one No. 2 Sturtevant Rotary Fine Crushers.**

**Ring Roll**

**Two—No. 0, two—No. 1 and one No. 2 Duplex Sturtevant ring roll mills.**

**Ball and Tube Mills**

**3', 4', 4½', 5', 5½', 6', 8' Hardinge Mills and Tube Mills.**

### DRYERS

**Two 3'x20', Three 4'x30', One 4½'x30', One 5'x40', Three 5½'x40', Two 6'x60', One 7'x60' and One 8'x80' Direct Heat Rotary Dryers, One 5'x25', one 6'x30', Two 8'x80' Ruggles Coles type "A" and One 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.**

### KILNS

4'x40', 5'x60', 6'x60', 6'x70., 6'x90', 6'x100', 6'x120', 7'x80', 8'x125'.

### MILLS

Two 33" and two 42" Fuller Lehigh Mills.
One No. 0000, and two No. 1, one 2-roll, and two 4-roll.
**Swing Hammer Mills, Griffin Mills, Attrition and Cage Mills.**
**Air separators, Screens, Elevators and Conveyors.**

**The Heineken Engineering Corp.**
**Industrial Engineers**
**95 Liberty St., New York City**
Hanover 2450

## LOCOMOTIVES

1—56-ton 6-wheel Standard gauge Saddle Tank, new A.S.M.E. boiler, electric head lights, oil burning equipment.

## LOCOMOTIVE CRANES

1—30-ton Ohio 8 wheel, double power drums, 50-ft. boom outriggers, factory rebuilt.
1—22½-ton Ohio 8 wheel, double power drums, 50-ft. boom, factory rebuilt.

## CATERPILLAR SHOVELS

1—68C Bucyrus electrically operated shovel on caterpillars.
1—20B Bucyrus Steam Shovel on caterpillars.

Morris Engineering Co.
**Phone: Cortland 0604**
**30 Church St., New York**

## BARGAINS

### In Stone Crushing Machinery

1—Set Sturtevant Balanced Rolls, 21"x11".
1—Kite Jaw Crusher, 7"x16".
1—Sturtevant Jaw Crusher, 8"x10".
1—Williams No. 2 Hammer Mill.
1—Sturtevant No. 2 Rotary Crusher.
1—Champion Jaw Crusher, 9"x15".
1—Jeffrey Type A Hammer Mill, 30"x24".
1—Allis Chalmers Roll Crusher, 24"x14".
3—6"x4" Bucket Elevators, 30' centers.
1—Sturtevant 3-Tier Moto Vibro Screen. Type MV, with screw feed.
1—3'x6' Trommel Screen.
1—100 H.P. Locomotive Type Boiler, 100-lb. pressure.
1—3½'x20' Direct Heat Rotary Dryer.
1—4'x20' American Process Dryer.
1—5'6"x40' Direct Heat Rotary Dryer.

**WE BUY YOUR SURPLUS EQUIPMENT**

**CONSOLIDATED PRODUCTS CO., INC.**
**15 Park Row, N. Y. C., Barclay 0603**

### CRAWLER SHOVELS

1—ERIE DREADNAUGHT, Steam, 1-yd.; HIGH LIFT; New 1926.
2—ERIE TYPE B; Steam, ¾-yd.; HIGH LIFT; New 1926 & 1925; also 40 ft. Crane Boom & Extra Drum, if desired.
1—BUCYRUS 41-B, Steam, 1¼-yd. dipper; New 1927.
2—THEW, TYPE O, GASOLINE; ¾-yd., HIGH LIFT; New 1926; Re-built.

### CRANES

1—30-ton, 8-wheel, BROWNING No. 3 Locomotive Crane, New 1921, A.S.M.E. & Mass. Boiler; 50 ft. & 70 ft. Boom; Bucket Operating.
2—12-ton McMYLER No. 2; GASOLINE, Caterpillar Cranes, New 1926; 40 ft. booms, ¾-yd. Clamshell Buckets; Like new.
1—10-ton BROWN HOIST No. 2, GASOLINE, Caterpillar crane, new 1924; 40 ft. boom, ¾-yd. Clamshell Bucket; Good condition.
2—10-ton McMYLER No. 2, STEAM, Caterpillar Cranes, New 1925; 45 ft. & 40 ft. booms; Bucket operating, Excellent condition.

### LOCOMOTIVES

4—12-ton, 36" gauge, VULCAN & WHITCOMB; Gasoline Locomotives; New 1926 & 1925; 100 HP. Motors; Like New.

**GREY STEEL PRODUCTS COMPANY**
**111 Broadway** **New York, N. Y.**

### CRUSHERS

Jaw Crushers; size 4x5 to 36x30.
Gyratory Crushers; No. 5, 6, 7½, 8, 9, 10.
Spare parts for Gates 9-K.

### CRUSHING PLANT

1—15x24 Jaw Crusher, complete with Elevator, screens, etc.

### NINE ROLL GRIZZLY

1—9" Roll Grizzly, 9" Discs x 42" (new).

### SCREEN

1—60"x20' all Manganese, for scalping or sizing.

### GASOLINE CRANE

1—New Industrial 15 ton double drums crawling tread.

### LOCOMOTIVES

2—Plymouth and 2 Vulcan, 8 ton, 36" gauge.

### DREDGE PUMPS

1—12" Suction, 12" Discharge, direct connected to and with 9"x9" double cylinder engine, all mounted on one base.
1—8" belt drive, all Manganese.

### DRYERS

1—Double shell 80"x45'.
1—Devine Vacuum Dryer 60"x33' with all equipment.

### PULVERIZERS

1—Sturtevant No. 2 Duplex Ring Roll Mill.
1—Fuller Lehigh Mill, 42" (NEW).
2—Shutz O'Neill D-28.

### BUCKETS

30—Clam Shell and Orange Peel Buckets ½ to 3 yd. capacity.

**A. J. O'NEILL CO.**
**406 Weightman Bldg., Philadelphia, Pa.**

# MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

J. J. URSCHEL

Mr. Urschel is President and General Manager of the Woodville Lime Products Company of Toledo and Woodville, Ohio.